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Data from Studies of Previous Radioactive Waste Disposal in Massachusetts Bay

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December 1984

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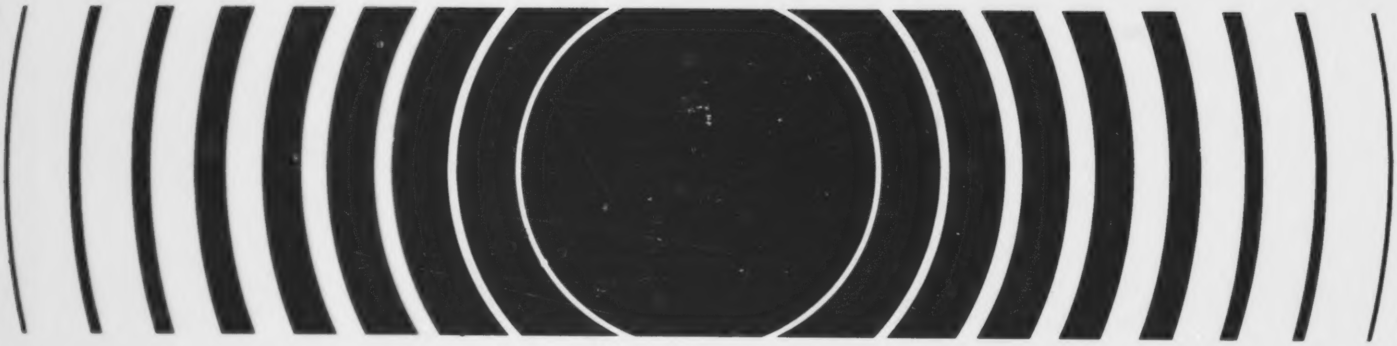

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This report presents the results of studies conducted in Massachusetts Bay during 1981 and 1982. Included are data from: (1) a side scan sonar survey of disposal areas in the Bay that was carried out by the National Oceanic and Atmospheric Administration (NOAA) for EPA; (2) Collections of sediment and biota by NOAA for radiochemical analysis by EPA; (3) collections of marketplace seafood samples by the Food and Drug Administration (FDA) for radioanalysis by both FDA and EPA; and (4) a radiological monitoring survey of LLW disposal areas by EPA to determine whether there should be any concern for public health resulting from previous LLW disposals in the Bay.

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DATA FROM STUDIES OF PREVIOUS RADIOACTIVE WASTE DISPOSAL IN MASSACHUSETTS BAY

DECEMBER 1984

William R. Curtis
H. Michael Mardis

Office of Radiation Programs

U.S. ENVIRONMENTAL PROTECTION AGENCY

Washington, D.C. 20460

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FOREWORD

In response to the mandate of Public Law 92-532, the Marine Protection, Research, and Sanctuaries Act of 1972, as amended, the Environmental Protection Agency (EPA) has developed a program to promulgate regulations and criteria to control the ocean disposal of radioactive wastes. As part of that program, the EPA Office of Radiation Programs initiated feasibility studies in 1974 to learn whether present technologies could be used to determine the fate of radioactive wastes disposed in the past.

Between 1946 and 1970, the United States disposed of low-level radioactive waste materials (LLW) at sea. The EPA has determined that approximately 112,000 containers of LLW were disposed off of the Atlantic and Pacific coasts of the U.S. Of this total, approximately 4,000 containers were disposed into Massachusetts Bay between 1946 and 1959.

Between 1974 and 1978, the EPA Office of Radiation Programs conducted environmental surveys of all other significant LLW disposal sites. The results of these studies were reported previously.

This report presents the results of studies conducted in Massachusetts Bay during 1981 and 1982. Included are data from: (1) a side scan sonar survey of disposal areas in the Bay that was carried out by the National Oceanic and Atmospheric Administration (NOAA) for EPA; (2) collections of sediment and biota by NOAA for radiochemical analysis by EPA; (3) collections of marketplace seafood samples by the Food and Drug Administration (FDA) for radioanalysis by both FDA and EPA; and (4) a radiological monitoring survey of LLW disposal areas by EPA to determine whether there should be any concern for public health resulting from previous LLW disposals in the Bay.

The concentrations of man-made radionuclides from samples collected were found to be within normally expected ranges of environmental background or ambient levels caused by global fallout levels measured in other samples from this region of the Atlantic Ocean. There is no indication that previous LLW disposals in Massachusetts Bay have resulted in contamination of the survey sites with waste-related radionuclides.

The Agency invites all readers of this report to send any comments or suggestions to Mr. David E. Janes, Director, Analysis and Support Division, Office of Radiation Programs (ANR-461), Environmental Protection Agency, Washington, DC 20460.

Sheldon Meyers

Sheldon Meyers, Acting Director
Office of Radiation Programs

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SECTION 1

INTRODUCTION

The increased use of radioactive materials in the United States since World War II has created substantial volumes of low-level radioactive wastes (LLW), which are routinely generated by nuclear power facilities, commercial manufacturing processes, military and nonmilitary research programs, and educational and medical institutions. LLW are generally defined as those radioactive waste materials not directly resulting from the processing of spent reactor fuel. The bulk of these wastes are either radioactive byproduct materials or equipment, tools, laboratory clothing, and other items that may have become contaminated by contact with radioactive materials. Some LLW byproduct radionuclides include radioactive cobalt, strontium, americium, and cesium. LLW materials may also include small quantities of source materials, such as uranium or thorium, and traces of special nuclear materials such as plutonium or enriched uranium.

Beginning in 1946, the United States disposed of LLW either by shallow-land burial at government-owned locations or by sea disposal at sites approved by the former Atomic Energy Commission (AEC). The AEC was responsible for disposing of LLW through contractor-operated national labs and issuing licenses to private companies for the packaging, transport, and ocean disposal of LLW. In 1960, the AEC imposed a moratorium on issuing new ocean disposal licenses but allowed existing licenses to remain in force, thus allowing disposal to continue. By 1963, however, most ocean disposal activities were phased out when the AEC began issuing licenses for LLW disposal at newly authorized, commercially operated land sites, which were found to be a more economical alternative. In 1970, the United States terminated all ocean disposal of radioactive waste materials.[1] NOTE: References are listed on pages 107, and 108.

In 1972, the Congress enacted the Marine Protection, Research and Sanctuaries Act (Public Law 92-532, commonly referred to as the Ocean Dumping Act), which authorized EPA to regulate ocean disposal of all types of waste. Furthermore, the Act directed the Secretary of Commerce, in conjunction with the Administrator of EPA, to "initiate a comprehensive and continuing program of monitoring and research regarding the effects of the disposal of materials into ocean waters . . . ."

In 1973, the United States ratified the 1972 London Dumping Convention, which prohibited the ocean disposal of, among other materials, high-level radioactive wastes (HLW), as defined by the

International Atomic Energy Agency (IAEA), and allowed for the future disposal of LLW only under controlled conditions stipulated by the Convention.

Since 1974, EPA has conducted environmental studies of the major LLW ocean disposal locations, under the authority of the Ocean Dumping Act. Pacific Ocean surveys, at the two Farrallon Island disposal locations, were conducted in 1974 and 1977. Surveys of the two Atlantic Ocean disposal locations, known as the 2800- and 3800-meter sites, were carried out in 1974, 1975, 1976, and 1978.[2]

Few studies of LLW disposal in Massachusetts Bay were conducted prior to 1981.[3] The recent EPA review of disposal records showed the amount of LLW disposed in Massachusetts Bay to be only a small portion of total U.S. sea disposals, yet it does contain the fourth largest quantity of LLW of all U.S. ocean disposal locations.[1] Also, Massachusetts Bay is a shallow-water disposal area, is close to a major metropolitan center, and is an area of active commercial fishing. In addition, as of 1981, Massachusetts Bay was the only remaining sea disposal area for LLW of possible public health significance that EPA had not surveyed. For these reasons, and because of public and Congressional concerns expressed about possible adverse effects from previous U.S. disposal of LLW in the Bay, EPA initiated action to determine whether LLW disposals in the Bay represented any potential hazards to the public health.

The extent of EPA action included:

1. Reviewing the records of LLW disposals in Massachusetts Bay and interviewing people actually involved in those disposal operations.
2. Obtaining the use of NOAA ships and personnel to perform a side scan sonar survey of the three most likely LLW disposal areas in the Bay.
3. Obtaining sediment and biota samples for radiochemical analysis from NOAA ships that routinely monitor environmental conditions in the Bay.
4. Initiating a cooperative program with the FDA to conduct radionuclide analyses of commercial seafood samples from Boston market places.
5. Conducting a comprehensive radiological monitoring survey in the Bay to measure levels of radioactivity that might be present in biota, sediment, and water collected from designated LLW disposal areas.

Sections 2 through 6 of this report describe each of the above EPA activities during 1981 and 1982. Data from each activity is provided in the individual sections and in the Appendices. Conclusions derived from the data are presented in Section 8.

SECTION 2

REVIEW OF DISPOSAL RECORDS

To determine the extent of ocean disposal of LLW between 1946 and 1970, the EPA researched available disposal records. Records of ocean disposal consist primarily of licenses issued by the AEC to private contractors and log books, maintained by the AEC, that indicate dates, approximate quantities of LLW disposed of, and the locations of disposals. In most cases, the nature of materials and their quantities and estimated radioactivity at the time of disposal are given, along with the navigational coordinates for disposal locations.

The records do not always provide specific information about isotopes or contents of individual waste containers, nor can disposal coordinates be precisely verified today. In contracting and licensing ocean disposal of LLW, the AEC designated only general areas for approved disposal of wastes. In some instances, these areas were identified by a single set of navigational coordinates, and waste disposals were concentrated within relatively specific areas. In other instances, however, the AEC designated much broader disposal areas and allowed disposers to proceed according to general guidelines, thereby resulting in broader disposal areas. LLW were generally packaged for disposal by one of two methods. They were either placed in special containers that were put inside steel drums capped with concrete or were mixed directly into concrete used to fill steel drums.[5]

The EPA, from reviewing available records, has determined that approximately 112,000 containers of LLW were disposed of at sea off the U.S. coasts. These containers were estimated to contain approximately 120,000 Curies of radioactivity at the time of disposal.[4] A total of 29 disposal locations were identified, four of which received most of the radioactivity.[1] These four locations include: one area in the Pacific Ocean near the Farallon Islands that contains 99 percent of the radioactivity disposed by the U.S. in the Pacific; two nearby sites in the Atlantic Ocean that received approximately 94.5 percent of the radioactivity disposed by the U.S. in the Atlantic; and Massachusetts Bay, which received about 2.3 percent of the Atlantic wastes between 1946 and 1959. Figure 1 shows the locations of these disposals.

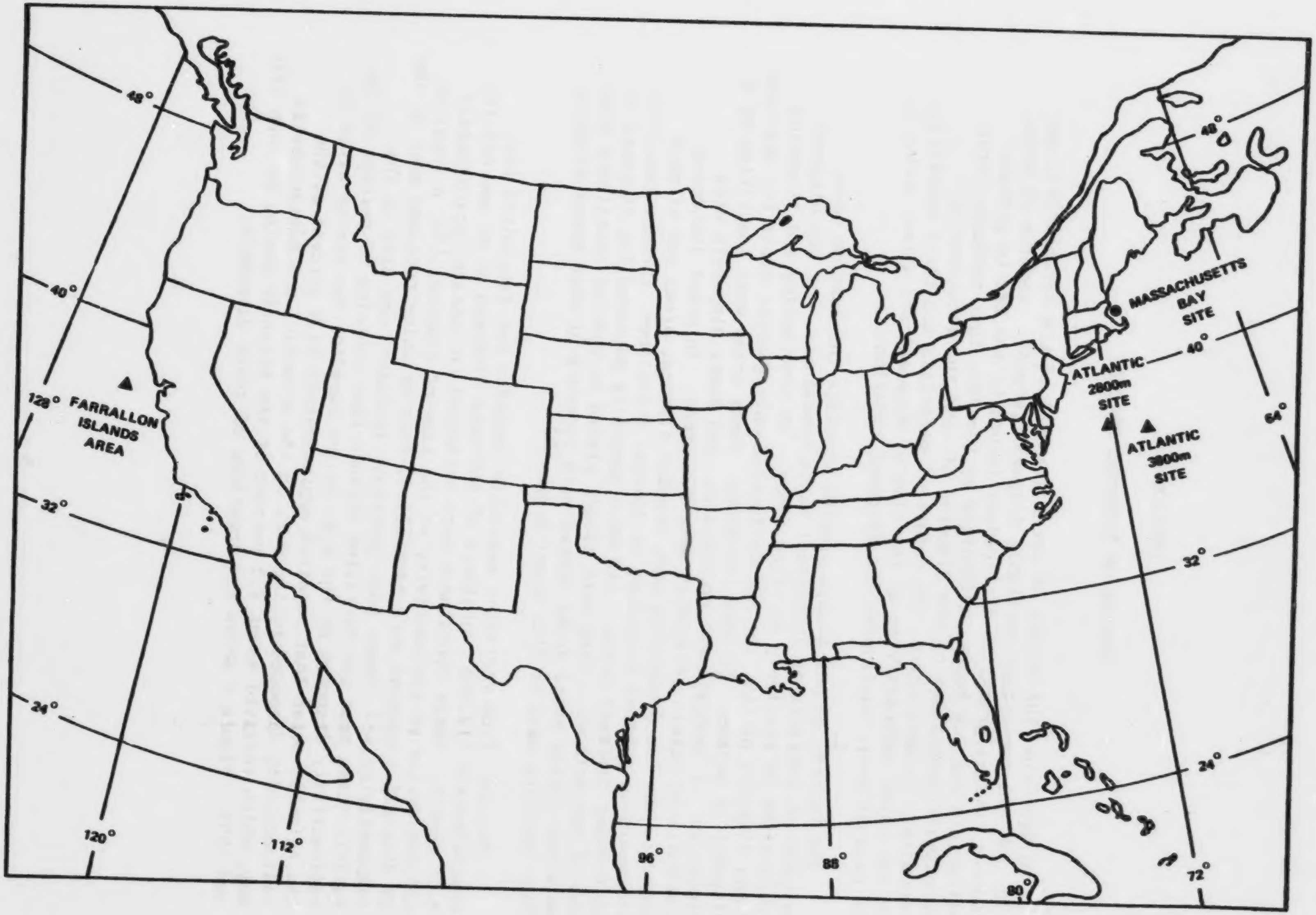

48°
40°
128°
FARRALLON ISLANDS AREA
32°
24°
120°
112°
96°
88°
80°
72°
64°
48°
MASSACHUSETTS BAY SITE
40°
ATLANTIC 2800m SITE
ATLANTIC 3800m SITE
32°
24°

FIGURE 1. LOCATIONS OF MAJOR U.S. OCEAN DISPOSAL AREAS FOR LLW, 1946-1970

In Massachusetts Bay, disposal of radioactive wastes was authorized by the AEC from 1952 to 1962. The only disposal license issued was to Crossroads Marine Disposal and Salvage Company, which was later renamed Crossroads Marine Disposal (CMD).[5] Navigational charts produced by the former Coast and Geodetic Survey between 1947 and 1956 show four areas in the Bay that were designated by the Army Corps of Engineers (ACE) for disposal of various wastes, including radioactive materials. These four areas are shown in Figure 2.

The main area designated for LLW disposal was the Boston Foul Site, which is located approximately 19 miles from Boston harbor (about 9 miles northeast of the location of the former Boston lightship) in approximately 300 feet of water. Records indicate that this was the only area actually used for LLW disposals. This area was selected because the bottom of the Bay in this site contained a deep layer of soft sediment into which waste containers would likely sink. Also, this was known as an area of sediment accumulation, making it likely that waste containers would continually be covered by additional sediment. This site had also been used for the disposal of other waste materials over a period of many years, including dredged material, rubble and construction debris, chemicals, and munitions.

CMD disposal records show that 4,008 containers of radioactive materials were received for disposal in Massachusetts Bay, including: 1,438 5-gallon pails, 1,860 30-gallon drums, and 710 55-gallon drums. In addition, CMD received 940 cubic feet of radioactive waste materials that would not fit into the standard-sized containers. The first request by CMD for a license, in 1952, alludes to 5 previous years of experience in disposing of waste materials into the Bay. Drawing upon that experience, CMD developed a unique approach to packaging of LLW. Radioactive waste containers, as received, were to be encased inside reinforced concrete before disposal. CMD had concluded that placing the wastes inside steel drums and using concrete as a "filler" was not a satisfactory method of disposing of LLW in the Bay, since drums might be crushed at depth and leak.[5]

Consequently, CMD normally placed unopened LLW containers in the center of specially designed molds for encasement in 4 to 5 inches of reinforced concrete. Such concrete molds were developed for standard container sizes of 5, 30, and 55 gallons. Special molds were also developed to encase any large, irregularly shaped pieces of equipment received for disposal. CMD marked each disposal container, after encasement, by inscribing the following information in the moist concrete: the letters XR (which stood for Crossroads), the date of packaging, the prevalent isotope in the container, the surface radiation of the encased materials, and the total activity in the container (if it were known). After encasement, the concrete was allowed to harden for several days before the container was transported to the disposal area. The encasement of containers and objects in reinforced concrete as specifically formulated to resist the corrosive effects from sea water

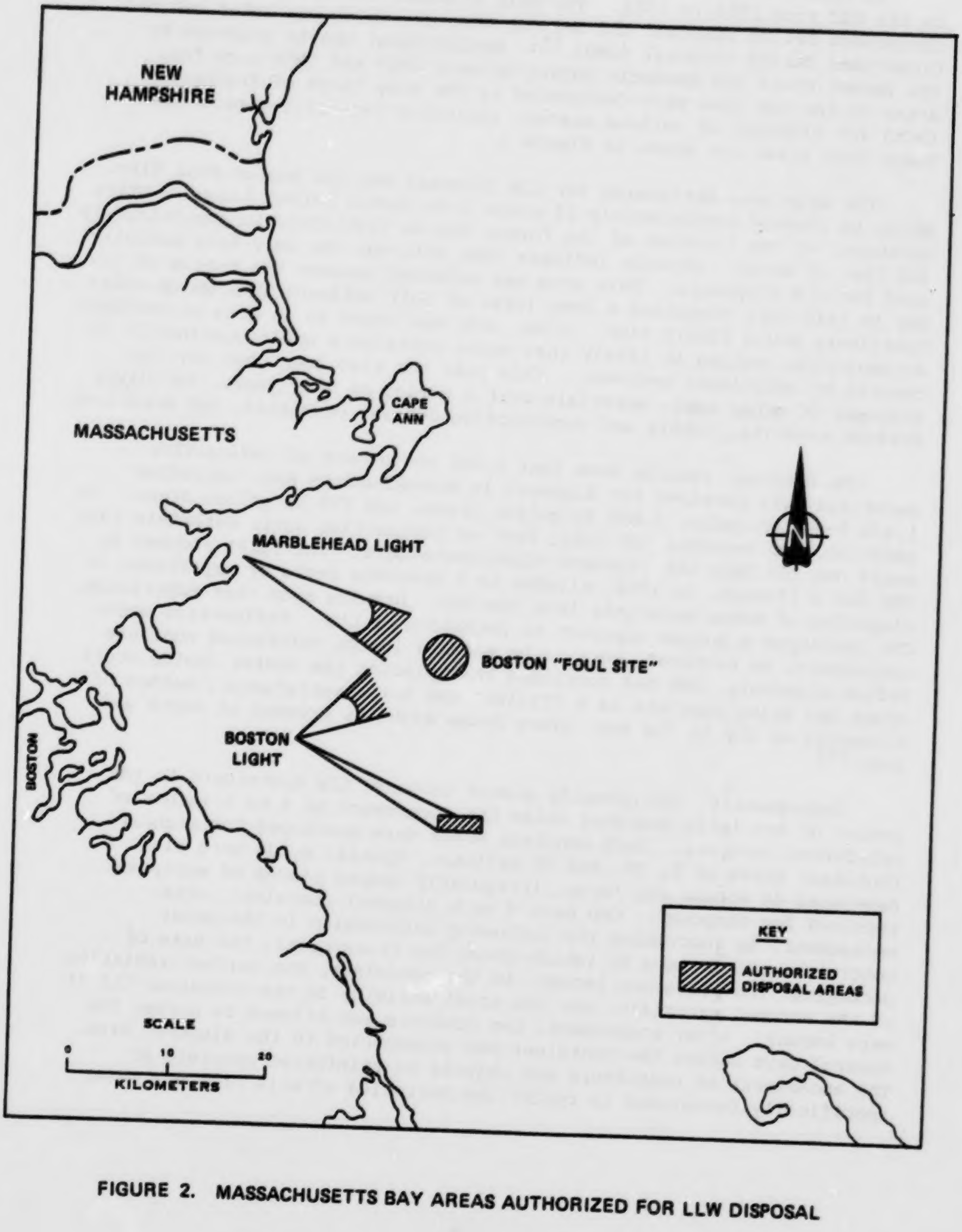

NEW HAMPSHIRE
MASSACHUSETTS
CAPE ANN
N
MARBLEHEAD LIGHT
BOSTON "FOUL SITE"
BOSTON LIGHT
BOSTON
KEY
▨ AUTHORIZED DISPOSAL AREAS
SCALE
0
10
20
KILOMETERS

FIGURE 2. MASSACHUSETTS BAY AREAS AUTHORIZED FOR LLW DISPOSAL

and was expected to withstand pressures of up to 600 pounds per square inch. In addition, the encased containers were designed to be heavy enough (from 600 pounds to more than a ton) to sink into the sediment of the Bay. Each container was expected to remain intact in its disposal environment for more than 800 years.[5]

A coastal tugboat and a barge were usually used for transport and disposal operations. The first AEC license issued to CMD in 1952 provided very general instructions describing the location of the disposal sites to the vessel operator--namely, to proceed on an approximate course heading for a fixed distance from the Boston lightship. At that time, disposal vessels were not equipped with precise navigational equipment. Navigation, then, was usually by dead reckoning-- following a magnetic course heading, at an estimated speed, for a fixed time period. After 1952, however, the main disposal area (Boston Foul Site) was marked by a Coast Guard buoy on its northern boundary during the several years that LLW disposal took place.

LLW disposed into Massachusetts Bay generally came to CMD from commercial, academic, and medical sources. Some defense-related nuclear wastes may have been disposed in the Bay as early as 1946; however, EPA has not been able to locate documentation showing the amounts or types of radioactive materials that may have been disposed in the Bay prior to 1952.[5]

Typical items that CMD received for disposal included potentially contaminated laboratory glassware, equipment, clothing, tools, and chemicals. The AEC estimated that the wastes in the 4,008 containers that were disposed of by CMD contained 2,440 Curies of activity at the time of disposal. These wastes would have included byproduct materials with isotope numbers ranging from 3 to 83, which CMD was licensed to handle.[5] Assuming these wastes contained the normal distribution of fission products, the levels of activity in these containers would by now have decreased, through radioactive decay, to a small fraction of the Curies that were estimated at the time of disposal.

Records indicate that no LLW disposals were conducted in Massachusetts Bay after 1959, even though the AEC had licensed CMD to continue disposing until 1962. In June 1960, the AEC established federal land disposal sites for LLW and, in July 1960, authorized CMD to ship LLW to sites in Oak Ridge, Tennessee, and Idaho Falls, Idaho. In 1962, after CMD was acquired by the Allied Maintenance Company, it applied for a transfer of its disposal license to the newly formed Allied-Crossroads Nuclear Corporation. This company continued handling LLW for land disposal until it requested license termination in 1967.

SECTION 3

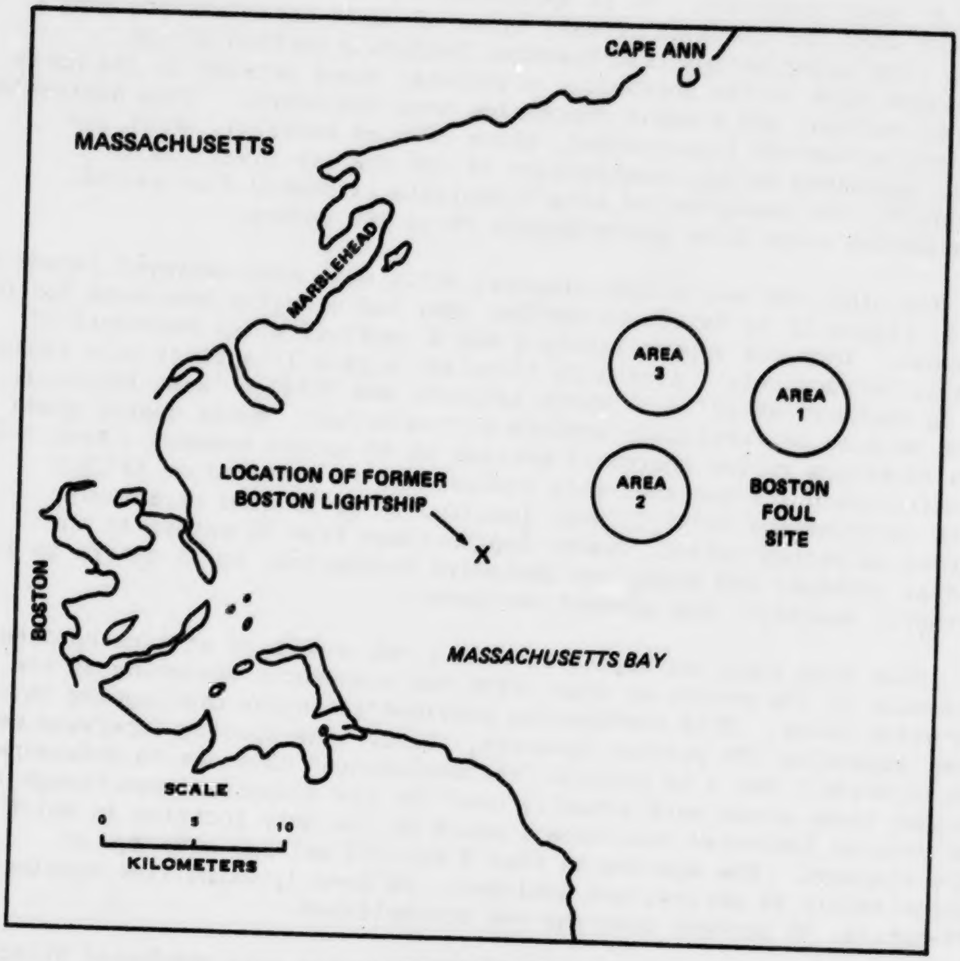
SIDE SCAN SONAR SURVEY

In 1981, EPA requested survey assistance from NOAA at designated LLW disposal areas in Massachusetts Bay to locate objects lying on the bottom that might be LLW containers. This was accomplished by conducting a side scan sonar survey of three areas in which LLW containers would most likely be found. Data from the NOAA survey would then be used by EPA to plan a radiological monitoring survey in the Bay.

The side scan sonar surveying technique is used to distinguish sea floor features and identify obstructions to navigation arising in the water column. An acoustical beam of fixed energy is emitted from a transducer that is towed through the water at a regulated depth and speed. The beam transmitted is very narrow in its horizontal plane and broad enough vertically to obtain reflection echoes from positions on the sea floor that may be either directly below the transducer or that range up to 500 meters on either side. The combination of beam shape (angle of search) and its very short acoustical pulse length enables resolution of small topographic irregularities and objects on the sea floor for observation on the recorder. The returning signal from the transducer is recorded on a chart, appearing as a flat-planed topographic map. A skilled side scan sonar operator can determine variations in topographic features, recognize differences in sediment density, and distinguish between natural materials and man-made objects lying on the bottom.

The NOAA National Ocean Survey vessel HECK, which routinely conducts hydrographic surveying and wire-drag recovery for removal of objects from coastal waters that may interfere with shipping, conducted the side scan sonar survey in September and October 1981. Survey equipment included a Klein model 531 system with a 100-kHz transducer, a Raytheon model R2640w navigational depth sounder, and a Hastings-Raydist model DRS-H primary-positioning navigational control system. Supplemental, simultaneous navigation was provided by a Del Norte trisponder system. Navigational control during the survey was determined to be accurate within 10 meters.

The three areas surveyed with side scan sonar are shown in Figure 3. These three areas coincide with the locations of three AEC-designated LLW disposal sites, as shown in Figure 2.


CAPE ANN
MASSACHUSETTS
MARBLEHEAD
AREA 3
AREA 1
AREA 2
BOSTON FOUL SITE
LOCATION OF FORMER BOSTON LIGHTSHIP
X
BOSTON
MASSACHUSETTS BAY
SCALE
0
5
10
KILOMETERS

COORDINATES

FORMER BOSTON LIGHTSHIP	42°20.5'N	70°45.5'W
CENTER, AREA 1	42°25.7'N	70°35.0'W
CENTER, AREA 2	42°23.3'N	70°40.6'W
CENTER, AREA 3	42°26.9'N	70°40.0'W

FIGURE 3. NOAA SIDE SCAN SONAR SURVEY – MASSACHUSETTS BAY, 1981

The first site selected for surveying was the Boston Foul Site (Area 1, Figure 3), since AEC records indicated that this was the primary area of LLW disposal in the Bay. This site is circular, with a 1-nautical mile radius, and is centered at 42°25.7' North latitude and 70°35.0' West longitude. It is approximately 19 miles from Boston and has been used for disposal of many types of waste materials for many years. Its major bathymetric features include a portion of the Stellwagen Bank in the northeast, a circular mound arising in its north central section, and a small depression near its center. This depression is known to contain fine-grained, black dredged material, which was likely deposited during construction of the Charles River Dam in Boston.[6] The remainder of Area 1 exhibits extremely flat relief. Water depths range from approximately 55 to 100 meters.

Two other AEC-authorized disposal sites were also surveyed (Areas 2 and 3, Figure 3) to determine whether they had actually been used for LLW disposal. They are approximately 2 and 3 nautical miles shoreward of Area 1, respectively. Area 2 is circular, with a 1-nautical mile radius, and is centered at 42°23.3' North latitude and 70°40.6' West longitude. It is an area of relatively uniform bottom relief. Water depths grade from 45 meters in its shoreward portion to 80 meters seaward. Area 3 is circular, with a 1-nautical-mile radius, and is centered at 42°26.9' North latitude and 70°40.0' West longitude. It is also relatively uniform in bottom relief. Water depths range from 50 meters in the central portion, and along its shoreward boundaries, to 75 meters in its northern, southern, and seaward sections.

Side scan sonar surveying in Area 1 was conducted at line-spacing intervals of 136 meters or less, with the transducer operating at the 100-meter range. This combination provided intensive overlapping in the area, exceeding 100 percent coverage. Wider line-spacing intervals were run in Areas 2 and 3 to provide "reconnaissance" coverage to determine whether these areas were actually used for LLW disposal, even though the AEC records indicated that Area 1 would be the only location in which LLW were disposed. The spacing in Area 2 was 453 meters; coverage of approximately 44 percent was achieved. In Area 3, using line spacing of 498 meters, 40-percent coverage was accomplished.

During the survey, navigational coordinates were annotated directly onto the side scan records at 4-minute intervals. Large, easily identifiable objects appearing on the records, such as sunken boats and barges, were noted and cross-checked on subsequent perpendicular and parallel lines to verify navigational accuracy. Observations of suspected, smaller man-made objects were also noted especially where the distribution pattern of these objects indicated that they may have been disposed from a slowly moving vessel. Completed side scan sonar records were then carefully analyzed. Within each survey area, groups of bottom objects that appeared similar in size, configuration, and density of material were delineated and labelled by letter code. The delineated objects were subsequently plotted on 1:5,000-scale plotting sheets to show actual geographic positions on the bottom in each survey area and were indexed by assigned-letter coding. The completed plotting sheets and original side scan records were then studied further to attempt to describe the types of objects observed. Figures 4, 5, and 6 present an interpretation of side scan sonar data collected during the survey.

Area 1, which is shown in Figure 4, contained extensive amounts of bottom objects, both grouped and dispersed. The data indicates that many of the objects are man-made and probably represent a variety of disposed materials, possibly including radioactive waste containers. Based upon the analysis of data, Area 1 was descriptively divided into four subareas.

1. Subarea A is the extreme northern portion of the disposal site. It appears to contain a relatively uniform bottom composition and is densely littered with large numbers of objects. Most of these objects appear to be man-made and probably represent items that were disposed from ships located near the Coast Guard buoy that was maintained at the northern edge of Area 1 for a portion of the time that LLW disposals occurred. Consequently, this subarea of Area 1 may be the most likely zone of LLW disposal in Massachusetts Bay.

2. Subarea B, in the northeastern section of this Area, is characterized by the intrusion of the Stellwagen Bank. Water depths rapidly shoal from 90 to 54 meters. Limited evidence of disposal was observed in this area; however, rapid changes in bottom topography result in less distinct side scan records, making identification of bottom objects less reliable than in areas of relatively uniform bottom relief.

3. Subarea C encompasses a large portion of the southeastern portion of Area 1 and is characterized by a very smooth, uniform bottom composition. The side scan data showed that this subarea was used mainly for dredged material disposals, as indicated by a similar density and distribution pattern for materials that is typically observed on side scan records after disposal of dredge materials.[13]

4. Subarea D comprises the remainder of Area 1, including the northcentral, central, and shoreward portions. Numerous groupings of bottom objects were observed, many of them apparently man-made, as well as natural rock outcrops and dredged material disposals. The center of Area 1 has been marked with a navigational buoy since 1969. The concentration of objects near the center of Area 1, and in this subarea, are probably man-made, since disposal of construction rubble from barges took place near the buoy during this survey of Area 1. This subarea is probably the second most likely zone within Area 1 to search for evidence of LLW disposals.

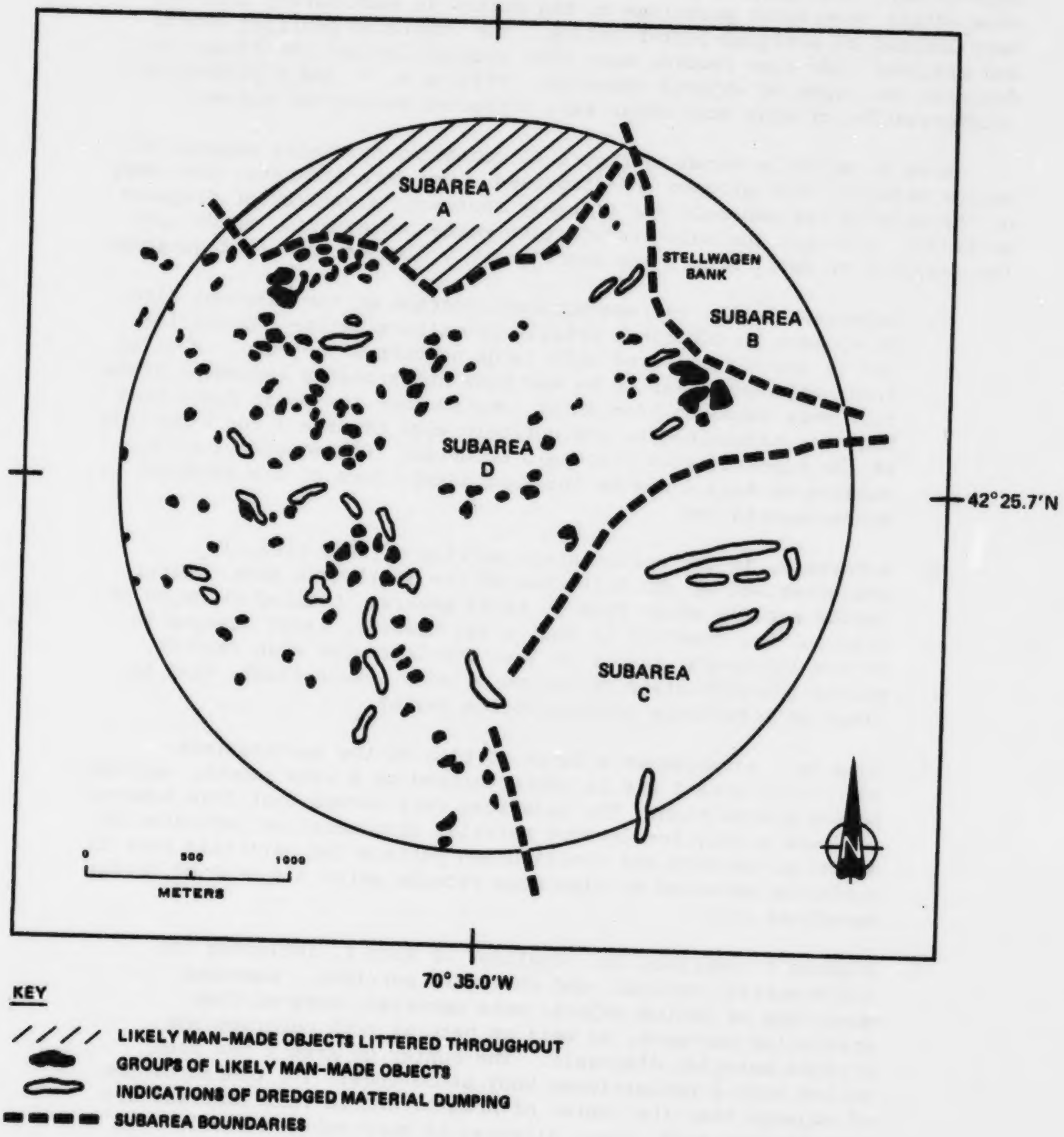

SUBAREA A
STELLWAGEN BANK
SUBAREA B
SUBAREA D
SUBAREA C
42°25.7'N
70°35.0'W
0
500
1000
METERS
N
KEY
LIKELY MAN-MADE OBJECTS LITTERED THROUGHOUT
GROUPS OF LIKELY MAN-MADE OBJECTS
INDICATIONS OF DREDGED MATERIAL DUMPING
SUBAREA BOUNDARIES

FIGURE 4. SIDE SCAN SONAR DATA PLOT – AREA 1 (BOSTON "FOUL SITE") MASSACHUSETTS BAY

Although Areas 2 and 3 were surveyed with less intensity than was Area 1, sufficient side scan sonar data was acquired to locate sections within each disposal area where man-made objects may be lying on the bottom.

Area 2 was found to be of relatively uniform bottom composition and, unlike Area 1, showed no obvious indications of dredged material disposals. The central and shoreward portions are almost devoid of any objects at all, either natural or man-made. Zones of high density sonar contacts were observed in the northern, southern, and seaward portions, but are much less concentrated in comparison to objects in Area 1, as was expected. Overall, the side scan data indicates much less evidence of man-made objects. Most of what was seen appears to be of natural origin, consisting of densely packed sediments and rock outcrops. Figure 5 is a generalized depiction of the side scan data obtained from Area 2.

Area 3 is characterized by a much less uniform composition of bottom materials than was observed in either Area 1 or 2. Zones of high-density sonar contacts were primarily observed in the southern and shoreward portions, but also at three northern and seaward locations. The side scan data indicates these zones to be probable rock outcrops. It is possible, however, that debris from man-made sources may be located within this area, although the presence of apparently natural, rocky objects makes identification of man-made objects more difficult. As with Area 2, no obvious signs of dredged material disposals were indicated. Figure 6 is a generalized depiction of where man-made objects may be located in Area 3.

In summary, the side scan sonar data indicates that significant numbers of probably man-made objects are clearly apparent in portions of Area 1. Data from Areas 2 and 3 provide much less evidence of probable man-made debris. When groups of bottom objects were delineated and plotted for Area 1, the distribution pattern appears to indicate that the objects may have been disposed from vessels moving slowly along a line in the disposal area. Considerable portions of each designated disposal area showed very few, if any, concentrations of bottom objects. It is possible that either no debris is located in these portions of the disposal areas or that objects that were disposed have been covered by sedimentation.

The side scan sonar data did not allow for positive identification of LLW containers on the bottom of Massachusetts Bay in any of the three areas surveyed, nor could it be expected to do so. The use of side scan, however, did locate concentrations of bottom objects that could be further studied by other survey techniques. Accordingly, EPA developed a plan for additional studying of each survey area, concurrent with the sampling of sediments and biota for radionuclide analyses.

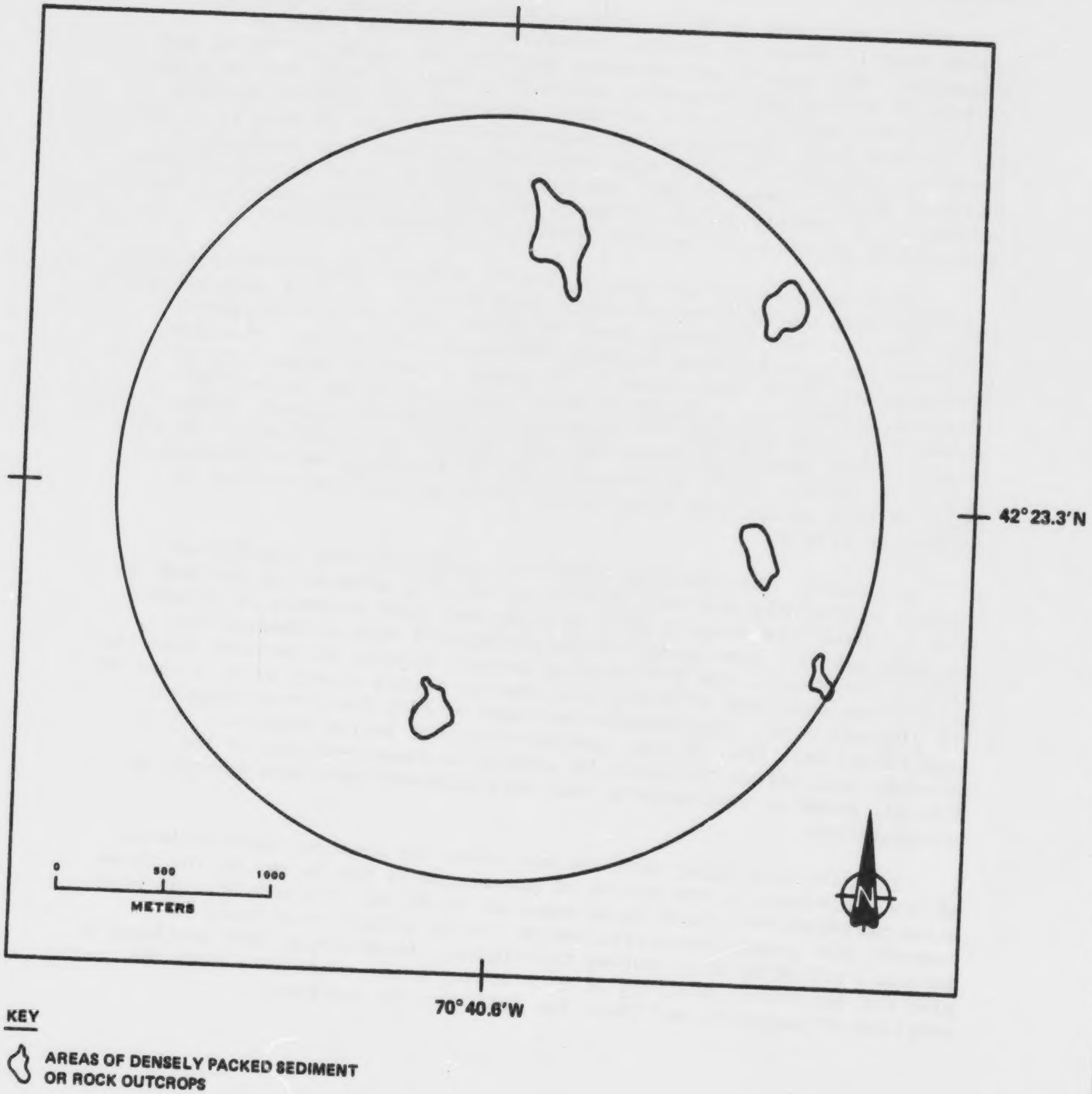

42°23.3'N
0
500
1000
METERS
N
70°40.6'W
KEY
AREAS OF DENSELY PACKED SEDIMENT
OR ROCK OUTCROPS

FIGURE 5. SIDE SCAN SONAR DATA PLOT, AREA 2, MASSACHUSETTS BAY

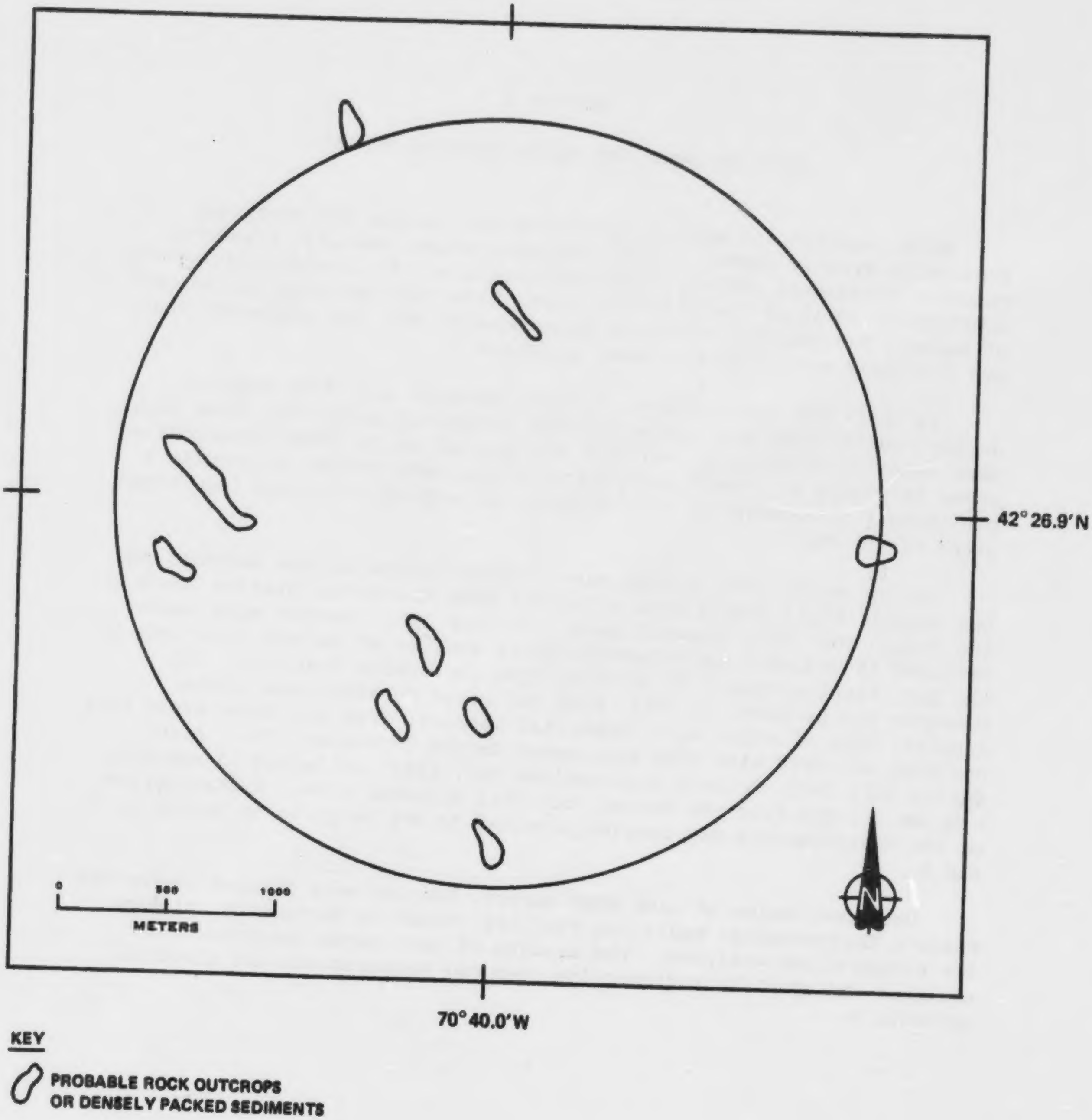

0
500
1000
METERS
N
42° 26.9′N
70° 40.0′W
KEY
PROBABLE ROCK OUTCROPS
OR DENSELY PACKED SEDIMENTS

FIGURE 6. SIDE SCAN SONAR DATA PLOT, AREA 3, MASSACHUSETTS BAY

SECTION 4

NOAA SEDIMENT AND BIOTA SAMPLING FOR EPA

NOAA research and monitoring activities include the Northeast Monitoring Program (NEMP). This program provides seasonal fisheries resource assessment and pollution monitoring at 140 locations along the continental shelf of the Atlantic Ocean, from Cape Hatteras to the Gulf of Maine. Embayments, including Massachusetts Bay, and dumpsites that are routinely monitored are shown in Figure 7.

In 1981, EPA asked NOAA to collect sediment and biota samples, during routine NEMP monitoring surveys in Massachusetts Bay, from three NEMP sampling stations in and near the Bay and at 11 other locations as shown in Figure 8. These sampling locations were chosen to provide a preliminary assessment of radioactivity in samples collected from broad areas of the Bay.

During April 1981, a NOAA survey vessel collected one sediment and one benthic biota sample from a routine NEMP monitoring station south of the Boston Foul Site disposal area. In July 1981, another NOAA vessel obtained 15 sediment and 4 benthic biota samples at various locations in the Bay, ranging from 5 to 29 miles from the Boston Foul Site. In November and December of 1981, NOAA collected 28 additional biota samples, many of which were commercial seafood, from the three areas that had been surveyed with side scan sonar during September 1981. Also, during July 1982, Science Applications Inc. (SAI) collected 13 sediment samples for EPA from the Boston Foul Site disposal area. A description of the Massachusetts Bay samples provided to EPA is given in Tables 1, 2, and 3.

Upon conclusion of each NEMP survey, samples were shipped to the EPA Eastern Environmental Radiation Facility (EERF) in Montgomery, Alabama, for radionuclide analyses. The results of both gamma spectrometric analyses and specific radionuclide chemical measurements are given in Appendix B.

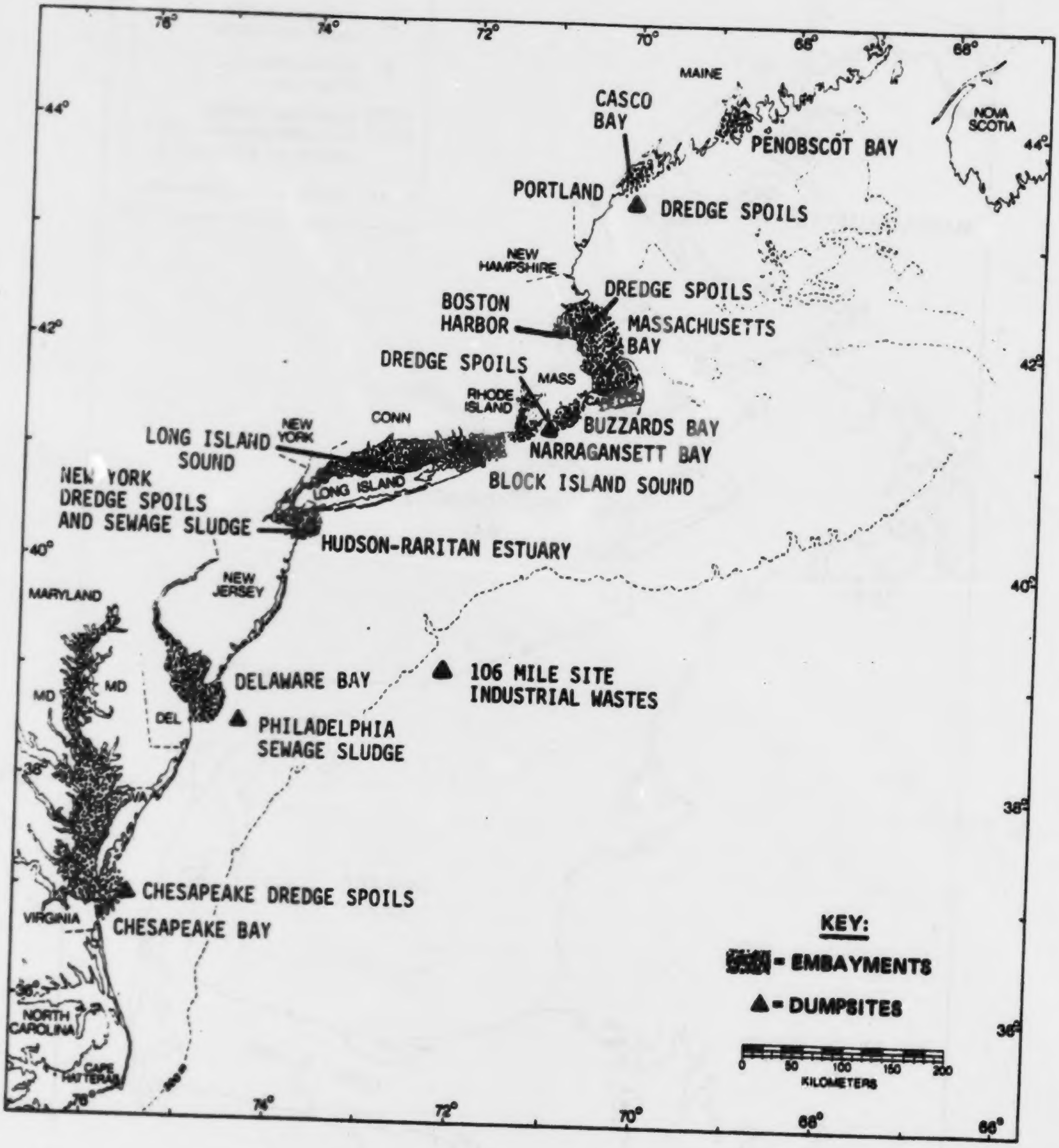

76°
74°
72°
70°
68°
66°
44°
42°
40°
38°
36°
MAINE
CASCO BAY
PENOBSCOT BAY
NOVA SCOTIA
PORTLAND
DREDGE SPOILS
NEW HAMPSHIRE
DREDGE SPOILS
BOSTON HARBOR
MASSACHUSETTS BAY
DREDGE SPOILS
MASS
RHODE ISLAND
CAPE
BUZZARDS BAY
NARRAGANSETT BAY
CONN
NEW YORK
LONG ISLAND SOUND
LONG ISLAND
BLOCK ISLAND SOUND
NEW YORK DREDGE SPOILS AND SEWAGE SLUDGE
HUDSON-RARITAN ESTUARY
NEW JERSEY
MARYLAND
MD
MD
DEL
DELAWARE BAY
PHILADELPHIA SEWAGE SLUDGE
106 MILE SITE INDUSTRIAL WASTES
VA
CHESAPEAKE DREDGE SPOILS
VIRGINIA
CHESAPEAKE BAY
NORTH CAROLINA
CAPE HATTERAS
KEY:
▨ = EMBAYMENTS
▲ = DUMPSITES
0
50
100
150
200
KILOMETERS

FIGURE 7. MAJOR ESTUARIES INCLUDED IN NEMP STUDIES

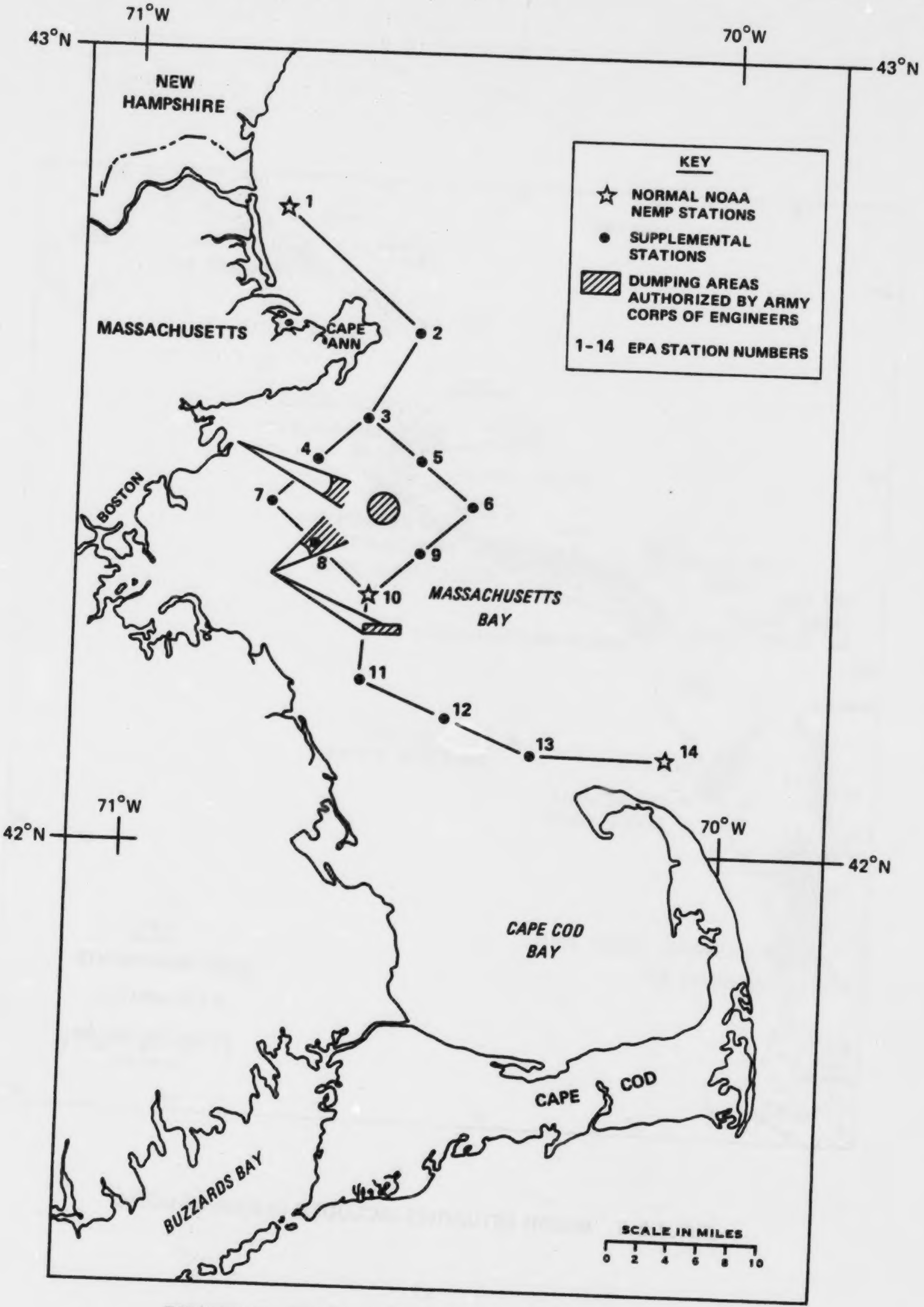

71°W
43°N
70°W
43°N
NEW HAMPSHIRE
KEY
☆ NORMAL NOAA NEMP STATIONS
● SUPPLEMENTAL STATIONS
▨ DUMPING AREAS AUTHORIZED BY ARMY CORPS OF ENGINEERS
1-14 EPA STATION NUMBERS
MASSACHUSETTS
CAPE ANN
BOSTON
MASSACHUSETTS BAY
1
2
3
4
5
6
7
8
9
10
11
12
13
14
71°W
42°N
70° W
42°N
CAPE COD BAY
CAPE COD
BUZZARDS BAY
SCALE IN MILES
0 2 4 6 8 10

FIGURE 8. STATIONS SAMPLED FOR EPA BY NOAA

TABLE 1
NOAA SEDIMENT SAMPLES - MASSACHUSETTS BAY, 1981

Station[(1)] No.	Date Collected	EERF[(2)] ID No.	Lat. (N)	Long. (W)	Sample Description
1	----	----	42°48'	70°45'	Station not occupied
2	21 July	15429	42°39'	70°31'	Mud
	21 July	15430(3)	42°39'	70°31'	Shells, rocks, and sand
3	----	----	42°33'	70°36'	No sample--rock bottom
4	21 July	15431	42°29'	70°41'	Gravel and clay
	21 July	15432(3)	42°29'	70°41'	Shells, rocks, and sand
5	21 July	15433	42°29'	70°31'	Coarse sand and gravel
	21 July	15434(3)	42°29'	70°31'	Shells, rocks, and sand
6	21 July	15435(3)	42°26'	70°26'	Fine sand and shells
	21 July	15436	42°26'	70°26'	Shells, rocks, and sand
7	----	----	42°26'	70°46'	No sample--rock bottom
8	21 July	15437	42°22'	70°41'	Gravel and mud
	21 July	15438(3)	42°22'	70°41'	Shells, rocks, and sand
9	21 July	15439	42°22'	70°31'	Mud
10	26 April	14473	42°19'	70°36'	Muddy clay
11	21 July	15441	42°13'	70°36'	Mud and rocks
12	21 July	15443	42°10'	70°28'	Mud
13	21 July	15446	42°07'	70°19'	Mud
14	21 July	15447	42°07'	70°06'	Coarse sand and gravel

Notes to Table:

(1) Station Nos. refer to Figure 8.
(2) Radionuclide analyses for these sample numbers are in Appendix B.
(3) These were also planned to be benthic biota sampling stations. No biota were collected during sampling - only bottom sedimentary materials.

TABLE 2
SAI SEDIMENT SAMPLES - MASSACHUSETTS BAY, 1982

Date Collected	SAI ID No.	EERF(1) ID No.	Lat. (N)	Long. (W)
7 July	2341	23940	42°26.2'	70°34.9'
7 July	2344	23941	42°26.2'	70°34.2'
7 July	2346	23942	42°26.2'	70°33.5'
7 July	2348	23943	42°25.9'	70°34.9'
7 July	2350	23944	42°25.9'	70°34.2'
7 July	2352	23945	42°25.9'	70°33.5'
7 July	2354	23946	42°25.6'	70°34.9'
7 July	2356	23947	42°25.6'	70°34.2'
7 July	2358	23948	42°25.6'	70°33.5'
7 July	2360	23949	42°25.4'	70°34.9'
7 July	2362	23950	42°25.4'	70°34.2'
7 July	2364	23951	42°25.4'	70°33.5'
7 July	2366	23952	42°25.1'	70°34.9'

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix B.

TABLE 3
NOAA BIOTA SAMPLES - MASSACHUSETTS BAY, 1981

Date Collected	EERF ID No.(6)	Lat. (N)	Long. (W)	Sample Description
Edible Samples				
10 Nov.	20347	42°26'	70°34'	Rock Crab
10 Nov.	20348	42°26'	70°34'	Silver Hake
10 Nov.	20349	42°26'	70°34'	Fourbeard Rockling
10 Nov.	20350	42°26'	70°34'	Grey Sole
10 Nov.	20351	42°26'	70°34'	Flounder
10 Nov.	20352	42°26'	70°34'	White Hake
10 Nov.	20353	42°26'	70°34'	Red Crab
10 Nov.	20355	42°26'	70°34'	Goosefish
10 Nov.	20357	42°26'	70°34'	Lobster
1 Dec.	20343	42°25'	70°35'	Shad
1 Dec.	20344	42°25'	70°35'	Silver Hake
1 Dec.	20345	42°25'	70°35'	Herring
1 Dec.	20346	42°25'	70°35'	Cod
1 Dec.	20358	42°25'	70°35'	Pollock
1 Dec.	20359	42°25'	70°35'	White Hake
1 Dec.	20361	42°25'	70°35'	Red Hake
3 Dec.	20362	42°23'	70°41'	Mackerel
3 Dec.	20363	42°23'	70°41'	Flounder
3 Dec.	20364	42°23'	70°41'	Silver Hake
3 Dec.	20365	42°23'	70°41'	Cod
3 Dec.	20366	42°23'	70°41'	Cod
3 Dec.	20367	42°23'	70°41'	Cod
3 Dec.	20368	42°27'	70°40'	Cod
3 Dec.	20369	42°27'	70°40'	Silver Hake
3 Dec.	20370	42°27'	70°40'	Cusk Eels
Nonedible Samples				
26 April	14474(1)	42°19'	70°36'	Starfish
21 July	15440(2)	42°22'	70°31'	Infauna
21 July	15442(3)	42°13'	70°36'	Infauna
21 July	15444(4)	42°10'	70°28'	Infauna
21 July	15445(5)	42°07'	70°19'	Infauna
10 Nov.	20354	42°26'	70°34'	Starfish
10 Nov.	20356	42°26'	70°34'	Skate
1 Dec.	20360	42°25'	70°35'	Starfish

Notes to Table:

(1) Station No. 10, Figure 8
(2) Station No. 9, Figure 8
(3) Station No. 11, Figure 8
(4) Station No. 12, Figure 8
(5) Station No. 13, Figure 8
(6) Radionuclide analyses for these sample numbers are in Appendix B.

SECTION 5

EPA/FDA MARKETPLACE SEAFOOD MONITORING PROGRAM

In 1981 EPA and NOAA drafted a "Program Plan for Monitoring Radioactivity in the Oceans." The plan outlined four types of monitoring needed to develop evaluation criteria for potential LLW ocean disposal permits as required of EPA by the Ocean Dumping Act, including: disposal site evaluation monitoring, baseline monitoring, radiation monitoring research, and public health monitoring. Public health monitoring focused on measuring the levels of radioactivity in seafoods commercially available in marketplaces near previously used LLW disposal sites, since the contamination of seafoods is the only significant way that humans could be affected by LLW disposals in the oceans. Thus, the monitoring plan proposed a program of sampling seafoods, for eventual radionuclide analysis, from San Francisco, Atlantic City, and Boston, each of which is near a major LLW ocean disposal area. Consequently, in the summer of 1981, EPA requested the FDA to initiate a periodic collection of seafoods for radionuclide analysis, as an extension of ongoing FDA sampling programs to evaluate seafoods for other than radioactive contaminants.

The FDA collected six seafood samples from Boston in September of 1981. A second series of six samples was collected in 1982. Emphasis was directed toward obtaining fish that were likely to be consumed and that were caught near or in LLW ocean disposal areas. Accordingly, fish samples were obtained from fishing boats at dockside after determining from each fisherman that his samples were caught near the disposal site. Each sample consisted of a single species of commercially marketable fish. A sufficient amount of sample was collected to yield 20 pounds of edible fish flesh for radionuclide analysis. These fish included bottom feeders, species indigenous to disposal areas, and migratory specimens. Samples were processed for analysis by the FDA Winchester Engineering and Analytical Center (WEAC) in Winchester, Massachusetts. For each sample collected, a blended homogenate was prepared of the edible portion. At WEAC, one-half of the blended homogenate for each sample was analyzed for gross gamma activity and strontium-90. Also, at least half of the sample homogenates were analyzed for plutonium. Methods of analysis are contained in references (14), (15), and (16). The remaining half of each sample's blended homogenate was shipped to the EPA Eastern Environmental

Radiation Facility (EERF) for duplicate radionuclide analysis. Table 4 describes the 14 samples collected by FDA from Boston marketplaces. Appendix C contains complete EERF results of both gamma spectrometry analyses and specific radionuclide chemical measurements for the samples provided by the FDA. Methods of analyses are given is Section 6, pages 74-77. A summary of the EERF analyses data for man-made radionuclides is given in Table 5. Similarly, Table 6 provides the results of analyses on these samples that were performed by WEAC. The data are discussed in Section 8 on page 105.

TABLE 4
SEAFOOD SAMPLES COLLECTED BY FDA FROM BOSTON MARKETPLACE

Date Collected	EERF(1) ID No.	WEAC ID No.	Sample Description
2 Sep. '81	15991	81-254-306	Flounder
2 Sep. '81	15992	81-254-306	Flounder
2 Sep. '81	15993	81-254-307	Flounder
2 Sep. '81	15994	81-254-307	Flounder
10 Sep. '81	16842	81-254-308	Hake
10 Sep. '81	16843	81-254-309	Cusk Eels
21 Sep. '81	16844	81-254-310	Flounder
21 Sep. '81	16845	81-254-311	Cod
10 June '82	26958	82-255-511	Flounder
13 Sep. '82	26959	82-255-892	Hake
13 Sep. '82	26960	82-255-893	Cod
2 Nov. '82	26961	83-255-842	Haddock
2 Nov. '82	26962	83-255-843	Cod
2 Nov. '82	26963	83-255-844	Pollock

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix C.

EERF sample numbers 15991 and 15992 are splits of WEAC sample 81-254-306.

EERF sample numbers 15993 and 15994 are splits of WEAC sample 81-254-307.

TABLE 5
SUMMARY, EERF ANALYSIS OF FDA MARKETPLACE (BOSTON) SEAFOOD SAMPLES(1)
(MAN-MADE RADIONUCLIDES)

EERF(2)	Cs-137		Pu-238		Pu-239		Sr-90	
I.D. No.	Activity	±2s	Activity	±2s	Activity	±2s	Activity	±2s
15991	ND	---	7.0×10^{-5}	1.7×10^{-4}	3.0×10^{-5}	7.4×10^{-5}	4.0×10^{-4}	1.3×10^{-3}
15992	ND	---	3.0×10^{-4}	1.4×10^{-4}	1.0×10^{-4}	6.7×10^{-5}	3.0×10^{-4}	3.0×10^{-4}
15993	1.7×10^{-2}	1.3×10^{-2}	-1.0×10^{-5}	9.2×10^{-5}	2.0×10^{-5}	4.0×10^{-5}	2.6×10^{-3}	6.0×10^{-3}
15994	1.3×10^{-2}	8.8×10^{-3}	8.0×10^{-5}	1.1×10^{-4}	9.0×10^{-5}	7.7×10^{-5}	-2.0×10^{-4}	6.0×10^{-4}
16842	ND	---	ND	---	2.0×10^{-5}	8.9×10^{-5}	-2.6×10^{-4}	3.4×10^{-4}
16843	3.1×10^{-2}	1.1×10^{-2}	5.8×10^{-4}	7.2×10^{-4}	8.2×10^{-5}	1.6×10^{-4}	2.2×10^{-4}	4.4×10^{-4}
16844	ND	---	1.7×10^{-3}	1.0×10^{-3}	1.0×10^{-4}	2.0×10^{-4}	2.1×10^{-4}	4.3×10^{-4}
16845	ND	---	8.0×10^{-4}	7.4×10^{-4}	-3.0×10^{-4}	2.7×10^{-4}	-2.1×10^{-4}	4.1×10^{-4}
26958	ND	---	5.8×10^{-5}	1.4×10^{-4}	-1.9×10^{-5}	8.5×10^{-5}	-2.1×10^{-3}	7.4×10^{-4}
26959	1.4×10^{-2}	1.0×10^{-2}	2.8×10^{-4}	1.6×10^{-4}	1.0×10^{-4}	9.2×10^{-5}	-1.0×10^{-3}	2.0×10^{-4}
26960	2.5×10^{-2}	1.4×10^{-2}	2.1×10^{-5}	1.1×10^{-4}	4.8×10^{-6}	1.8×10^{-5}	-6.0×10^{-4}	9.0×10^{-4}
26961	ND	---	1.1×10^{-4}	1.9×10^{-4}	2.1×10^{-5}	4.5×10^{-5}	-1.0×10^{-3}	1.2×10^{-3}
26962	5.0×10^{-3}	3.3×10^{-3}	2.6×10^{-4}	2.1×10^{-4}	-4.0×10^{-5}	7.9×10^{-5}	-1.0×10^{-3}	1.3×10^{-3}
26963	1.5×10^{-2}	1.1×10^{-2}	2.5×10^{-4}	1.5×10^{-4}	1.7×10^{-4}	1.2×10^{-4}	1.0×10^{-3}	1.8×10^{-3}

Notes to Table:

Units = pCi/g/Wet
±2s = 2 Sigma Counting Error
ND = Not Detectable

(1) Negative numbers indicate that sample activity was less than normal background activity that is detected by the radiation measuring instrument when no sample is being measured (See Section 7 for discussion).

(2) Complete radionuclide analyses results for these sample numbers are in Appendix C.

TABLE 6
RESULTS FOR FDA/WEAC ANALYSES OF MASSACHUSETTS BAY SAMPLES
EPA/FDA MARKETPLACE SEAFOOD SAMPLING PROGRAM

WEAC Sample No.	I-131(2)	Ba-140(2)	Cs-137(1)	Sr-90(2)	Pu-239(2,3)
81-254-306	ND	ND	ND	ND	ND
81-254-307	ND	ND	1.8×10^{-2}	ND	NA
81-254-308	ND	ND	4.5×10^{-2}	ND	NA
81-254-309	ND	ND	ND	ND	ND
81-254-310	ND	ND	1.3×10^{-2}	ND	NA
81-254-311	ND	ND	ND	ND	ND
82-255-511	ND	ND	ND	ND	ND
82-255-892	ND	ND	ND	ND	NA
82-255-893	ND	ND	1.7×10^{-2}	ND	ND
82-255-842	ND	ND	ND	ND	ND
82-255-843	ND	ND	1.2×10^{-2}	ND	NA
82-255-844	ND	ND	ND	ND	NA

Notes to Table:

(1) Units are pCi/g.
(2) ND = None Detected.
(3) NA = No Analysis Performed.

Limits of Detection:

1.0×10^{-2} pCi/g at 2 Sigma level for I-131, Ba-140, Cs-137.
2.0×10^{-3} pCi/g at 2 Sigma level for Sr-90.
1.0×10^{-4} pCi/g at 2 Sigma level for Pu-239.

SECTION 6

EPA RADIOLOGICAL MONITORING SURVEY

This survey was conducted to evaluate the radiological environment within four areas in Massachusetts Bay that had been authorized by the AEC in 1952 for LLW disposal. This evaluation was needed to determine whether there should be any significant concern regarding public health resulting from previous LLW disposals in the Bay.

Figure 9 shows the locations of areas surveyed. Three of the circular areas, labelled 1, 2, and 3, are designated LLW disposal areas that were surveyed with side scan sonar by NOAA in 1981. The rectangular area is the fourth LLW disposal area that was authorized by the AEC. It is designated as Survey Area 5 in this report. The circular area northeast of Cape Ann is a baseline reference area that was selected to be used for comparison to data collected within the designated disposal areas. It is labelled Area 4 in this report. The criteria used to select the reference area were: (1) proximity to disposal sites, but not used for disposal of any kind of waste materials; (2) location upstream of normal water circulation patterns in the Bay[7]; and (3) environmental similarity, with respect to water depth and sediment composition, to the designated disposal areas.

The primary objectives of this survey were: (1) to obtain from each area a uniformly spaced series of biota and sediment samples that would be analyzed for the presence of specific radionuclides, (2) to acquire in-situ measurements of radioactivity of bottom sediments within each area surveyed, and (3) to attempt visual identification of objects observed in three of the areas during the previous NOAA side scan sonar survey.

This survey was conducted in September 1982, using the EPA ocean survey vessel ANTELOPE. Participating scientists were from the EPA Office of Radiation Programs, the EPA Office of Water Programs, the NOAA Office of Oceanography, the NOAA National Marine Fisheries Service, the Massachusetts Department of Public Health, the Massachusetts Division of Water Pollution Control, the U.S. House of Representatives Subcommittee on Coast Guard and Navigation, the Battelle New England Marine Laboratories, and Science Applications, Inc. (SAI) of Newport Beach, Rhode Island. (See Acknowledgments Section for a list of names.)

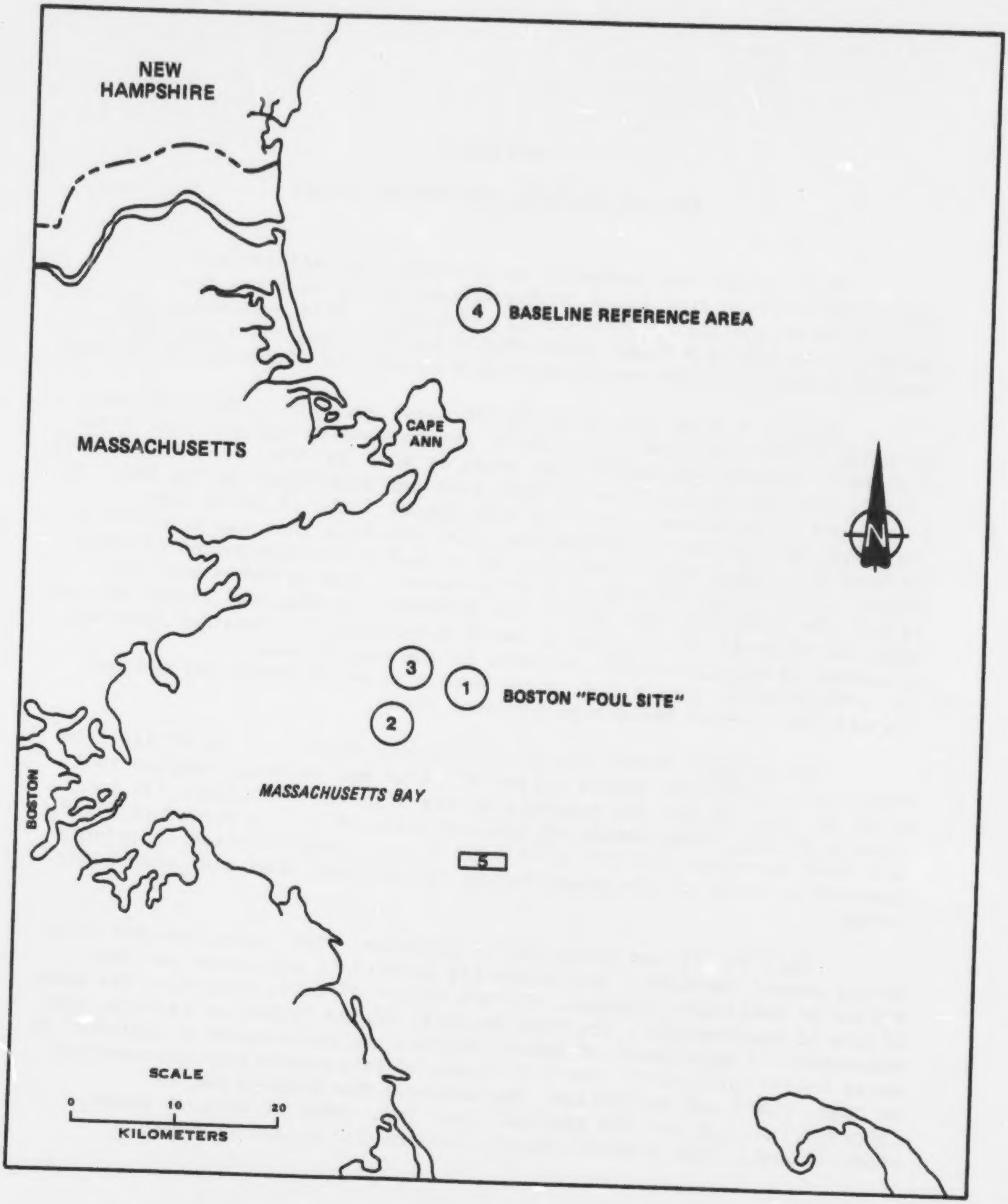

NEW HAMPSHIRE
MASSACHUSETTS
CAPE ANN
4 BASELINE REFERENCE AREA
N
3
1 BOSTON "FOUL SITE"
2
BOSTON
MASSACHUSETTS BAY
5
SCALE
0
10
20
KILOMETERS

FIGURE 9. EPA RADIOLOGICAL MONITORING SURVEY AREAS – SEPTEMBER 1982

6.1 EQUIPMENT

During other EPA ocean dumpsite surveys, the ANTELOPE routinely uses the LORAN navigational system. For this specific survey, ANTELOPE was additionally equipped with a computerized navigation system, provided by SAI, that was linked to a Del Norte trisponder and control station network that had previously been established in Massachusetts Bay. Use of this specialized navigational equipment enabled the ANTELOPE to accurately reposition along survey lines used during the previous NOAA side scan sonar survey. Such precise navigational accuracy was needed to effectively view objects with underwater television that were located previously by side scanning and to position the sampling equipment near those objects. The resulting accuracy of repositioning was found to be within 5 meters of the original coordinates.

Sampling equipment used to collect biota, sediments, and water is routinely maintained aboard ANTELOPE and was used for this survey. Sediment samples were obtained with a Smith-McIntyre grab, model 214WA250 as manufactured by KAHL Scientific Instruments. Closed dimensions were 11.5 inches by 13 inches at the wire-mesh, top end of the grab. It was 6.5 inches deep. Biota sampling was accomplished by using otter trawls for benthic and demersal organisms and Bongo-type, mid-water tow nets for pelagic specimens. The otter trawl nets measured 17 feet across at the mouth end and were 30 feet long. Net mesh size was 1.5 inches. The mid-water tow nets were 22 feet wide at the open end and were 35 feet long. Net mesh size was 1 inch. Microscopic biota sampling was conducted concurrently during mid-water trawling by affixing a fine-mesh plankton net and collection bucket inside the terminal end of the Bongo net. Water samples were collected in GO-FLOW sampling bottles, manufactured by General Oceanics.

ANTELOPE was also equipped with an underwater television system and a side scan sonar system. Both systems were provided by SAI. The underwater television system included: (1) a color camera with tilt, pan, and remote focusing capabilities and housed in a water-tight casing; (2) a color video monitor installed in the navigational survey control compartment aboard ANTELOPE; (3) an underwater towing sled with stabilizer fins, on which the camera unit and two strobe lights were mounted; and, (4) all associated electronic cable and connectors. The side scan sonar system was identical to the one used by NOAA in 1981.

Specialized instruments to measure radiation were provided by EERF. A Northern Scientific multichannel analyzer, connected to a 3-inch by 3-inch sodium iodide crystal, was used in determining the levels of radioactivity in sediment and biota samples brought aboard ANTELOPE. An underwater gamma-radiation detection system was used to obtain in-situ measurements of radioactivity. This system included a Davidson multichannel analyzer, connected to a 4-inch by 4-inch sodium iodide crystal. The crystal, photomultiplier tube, and preamplifier were encased in a pressure-resistant, water-tight aluminum casing that was mounted inside a tripod leg array designed to allow the instrument to rest upright when lowered to the bottom of the Bay. Direct data was received aboard ANTELOPE via the electronic support cable.

6.2 SURVEY PROCEDURES

The pre-survey plan (see Appendix A) established a grid-sampling pattern to acquire sediment and biota samples from the four areas of the Bay designated for LLW disposal and from a reference area (Figure 9). The sampling plan was based primarily on the NOAA side scan sonar data acquired in 1981 from three of the designated disposal areas (Figures 4, 5, and 6). Thus, a random sampling strategy was not used to collect sediment or biota during this survey. Samples were to be collected at relatively uniform intervals within each area and from additional locations near bottom debris, identified by side scan, that potentially represented disposals.

Efforts were made to uniformly sample within each area during the survey in accord with the pre-survey plan. Some deviations from the plan were made onboard by the Chief Scientist as needed when survey time was reduced due to periods of adverse weather and malfunctions to operating equipment and sampling devices.

When sampling sediments, stations were generally occupied at the planned locations. The Smith-McIntyre grab provided a relatively undisturbed sample large enough for radionuclide analysis. As each sample was collected, two portions were removed from its center. A small aliquot was collected in a plastic vial for onboard analysis. A larger portion was containerized and stored frozen for post-survey, detailed analysis.

The numbers and locations of biota trawling stations were changed from the original survey plan to improve survey operational efficiency and because the yield of specimens from otter trawling was much more abundant than had been expected. The increased yield of biota required more time and personnel to process specimens between trawling stations. Also, because of the predominance of high seas and wind during this survey, the direction of towing for some biota trawls was changed from the pre-survey plan to provide for safer and easier sampling operations. Furthermore, mid-water trawling was accomplished as a separate event in each survey area, rather than occurring concurrently with otter trawling as originally planned, since concurrent biota sampling was not possible on the ANTELOPE.

As each biota trawl was brought on deck, individual specimens were sorted into groups of similar type and collected in plastic bags. Subsequently, each fish sample was then removed for identification and length measurements. Nonfish samples were collectively weighed when each trawl was completed. After initial processing, biota samples were randomly selected, by station number and type of biota collected per station, for onboard measurement of radioactivity. All biota samples, including those used for onboard analyses, were containerized and stored frozen for post-survey, detailed radionuclide analysis. Sufficient sample sizes were collected to fulfill analysis requirements specified by EERF in the pre-survey plan.

Water samples were obtained by use of either the electronic Rosette/ Niskin sampler or by hydrocast technique. Near-bottom and sub-surface samples were collected. One-liter aliquots were drawn and stored frozen. Sampling was generally accomplished at central locations within survey areas.

Two techniques were used to acquire in-situ radiation measurements. One technique was to lower the radiation detector in its tripod leg array as an individual unit. The gamma radiation detector, when lowered to the Bay bottom, was approximately 6 inches above bottom sediment. During lowering and operation, ANTELOPE remained on station for a period of 30 to 60 minutes while the detector was recording data. A second technique was used to combine the underwater gamma radiation detector and television system into one unit. The detector was removed from its tripod leg array and affixed directly behind the television camera inside the tow sled. In this position, its height above bottom sediment was the same as when used individually. In-situ radiation measurements were then attempted while the sled was slowly towed along, or slightly above, the bottom of the Bay. This method, however, did not prove to be satisfactory because of excessive instrument "noise" appearing on the recorder. Valid data was collected only when the sled was allowed to rest on the bottom while measurements were being conducted. With both techniques, during lowering, ambient radioactivity of the water column was measured for comparison to measurements made while the system was operating at depth. Calibrations were conducted on deck during the survey and showed that the detector was sensitive to 1 microcurie of Cesium-137 at a distance of 1 meter.

A limited amount of side scan sonar data was collected, as planned. Area 4 was studied in detail to search for evidence of man-made objects lying on the bottom that might indicate waste disposals, thus precluding its use as an effective baseline reference area. Also, a few of the original NOAA survey lines were partially re-surveyed in Area 1 to ensure that the specialized navigational equipment was providing the desired repositioning capability. Procedures followed in side scanning were in general accord with those used during the 1981 NOAA survey.

Use of underwater television was limited to much less than had been planned because of technical problems with shipboard equipment and the television system itself. During testing of the system, early in the survey, it was determined that obtaining good video quality was dependent upon the speed of towing. A 1-knot towing speed was found to be best suited for maintaining quality video resolution in generally turbid waters, for keeping the tow sled on a level plane, and for minimizing chances of fouling the tow sled on debris, particularly in disposal areas. Also, use of the ANTELOPE bow thruster for propulsion during underwater television surveying, rather than running at reduced power on one main engine, was determined to be the best method to achieve desired towing speed.

Unfortunately, the bow thruster was not available during much of the time used for underwater television surveying because of hydraulic and mechanical system malfunctions. In addition, direct power to the television system was not available during its use in Area 1 because of a short-circuit in the electronic cable. Battery power was used in this instance; however, its use eliminated using the tilt, pan, and remote focusing features of the camera. Consequently, two different techniques were used for the limited underwater television surveying that was accomplished.

The first technique was used when both the bow thruster and electronic cable were operational and involved assembling and testing the television system on deck while ANTELOPE was positioning to start surveying. At a short distance from the starting point, the tow sled was slowly lowered to depth while ANTELOPE maintained headway and course. Proper focus, angle of view, and resolution of video were adjusted as the sled approached bottom. During towing over the desired distance, tow cable length was adjusted by winch to maintain uniform distance above bottom, to enhance video resolution, and to be able to avoid potentially obstructive objects that might appear on the video monitor. When the bow thruster was not available and battery power was being used, a drifting survey was conducted, with ANTELOPE's main engine used intermittently to maintain desired course. To preserve battery power, on-deck testing was reduced to a quick on/off system test, and focal range and viewing angle were preset. The sled was lowered to proper distance above bottom and towed downwind and downstream for the duration of battery life. Cable length was adjusted by winch, as in the first survey technique. Video resolution, although not as precise, was sufficient for survey use.

6.3 DATA COLLECTED

In planning and surveying, priority was given to collecting sediment and biota samples for detailed post-survey radionuclide analyses. Data from these analyses would be most useful in determining whether previous U.S. disposals of LLW in the Bay had resulted in contamination from waste-related radionucldies. Accordingly, most of the survey time was expended in obtaining numerous sediment and biota samples from each of the survey areas.

A considerable amount of environmental sampling and data collection was completed during this survey, as shown in Table 7. The types of biota collected are listed in Tables 8 and 9 and include those fish and shellfish locally marketed for human consumption (edible). The locations of all sediment and biota samples, and other data collected, are given in the figures and tables that follow for each survey area.

TABLE 7
EVENTS COMPLETED WITHIN EACH SURVEY AREA

Area	Underwater Television	Side Scan Sonar Data	*In-situ* Measurements	Sediment Samples	Trawls for Biota		Water Samples
					Benthic	Midwater	
4	2 1/2 hours	9 hours	3	26	7	3	1
1	3 hours	3 hours	5	47	10	3	1
2	None	None	2	24	7	3	2
3	None	None	2	16	5	5	1
5	None	None	None	2	1	None	None
Totals	5 1/2 hours*	12 hours**	12	115	30	14	5

Notes to Table:

* = approximately 4 nautical miles
** = approximately 22 nautical miles

TABLE 8
INVENTORY OF MARKETABLE (EDIBLE) BIOTA COLLECTED

	Number of Specimens from Area					Total from All Areas
	1	2	3	4	5	
A. FISH						
1. FLOUNDER FAMILIES (*Pleuronectidae & Bothidae*) American plaice (*Hippoglossoides platessoides*) Yellowtail (*Limanda ferruginea*) Witch (Gray sole) (*Glyptocephalus cynoglossus*) Winter (*Pseudopleuronectes americanus*) Summer (*Paralichthys dentatus*)	376	34	11	90	2	513
2. SILVER HAKE & COD FAMILIES (*Merlucciidae & Gadidae*) American Cod (*Gadus morhua*) Squirrel (Red) Hake (*Urophycis chuss*) Silver Hake (*Merluccius bilinearis*) White Hake (*Urophycis tenuis*)	207	24	19	245	-	495
3. SCORPIONFISH FAMILY (*Scorpaenidae*) Ocean Perch (*Sebates marinus*)	94	3	3	-	-	100
4. EELPOUT FAMILY (*Zoarcidae*) Ocean Pout (*Macrozoarces americanus*)	2	11	10	2	-	25
5. HERRING FAMILY (*Clupeidae*) Atlantic Herring (*Clupea harengus*)	1	-	-	-	-	1
B. NON-FISH						
1. Lobsters (*Homarus americanus*)	1	2	-	-	-	3
2. Scallops (*Pecten irradians*)	1	-	-	7	-	8
3. Crabs (*Cancer sp., Geryon sp., Libinia sp., and Pagurus sp.*)	12	-	-	5	-	17
4. Shrimp(1) (*Peneus sp.*)	43(2)	-	-	11(2)	-	54(2)
5. Octopoda	7	2	-	9	-	18

Notes to Table:
(1) Krill not included.
(2) Pounds - not individuals.

TABLE 9
INVENTORY OF NONEDIBLE(1) BIOTA COLLECTED

	Number of Specimens from Area					Total from All Areas
	1	2	3	4	5	
A. **FISH**						
Cunner (*Tautogolabrus adspersus*)	-	1	-	-	-	1
Cusk Eel (*Rissola marginata*)	-	5	-	3	-	8
Lizard Fish (*Synodus foetens*)	128	-	-	-	-	128
Sand Launce (*Ammodytes americanus*)	-	-	-	1	-	1
Sculpin (*Hemitripterus americanus*)	1	-	-	8	-	9
Sea Robin (*Prinotus carolinus*)	4	-	3	-	-	7
Toad Fish (*Opsanus tau*)	3	1	-	-	-	4
B. **OTHERS**						
Anemones (*Anthozoa*)	2	-	4	-	-	6
Brittle Stars (*Ophiurida*)	*	*	*	*	*	*
Hagfish (*Myxine glutinosa*)	3	-	-	6	-	9
Sandworm (*Nereis sp.*)	1	-	-	-	-	1
Sea Cucumbers (*Holothurida*)	*	-	1	*	2	*
Sea Mice (*Aphrodite sp.*)	*	-	-	*	-	*
Sea Urchins (*Echinida*)	-	*	4	*	1	*
Skates (*Raja sp.*)	4	2	-	-	-	6
Snake Eels (*Ophichthys sp.*)	2	-	-	-	-	2
Sponges (*Demospongiae*)	*	*	*	-	-	*
Starfish (*Asterida*)	*	3	13	35	4	*
C. **PLANKTON**						
Copepods	*	*	*	*	*	*
Mysid Shrimp (*Krill*)	*	*	*	*	*	*
D. **FROM SEDIMENT SAMPLES**						
Crustacea	*	*	*	*	*	*
Polychaeta	*	*	*	*	*	*

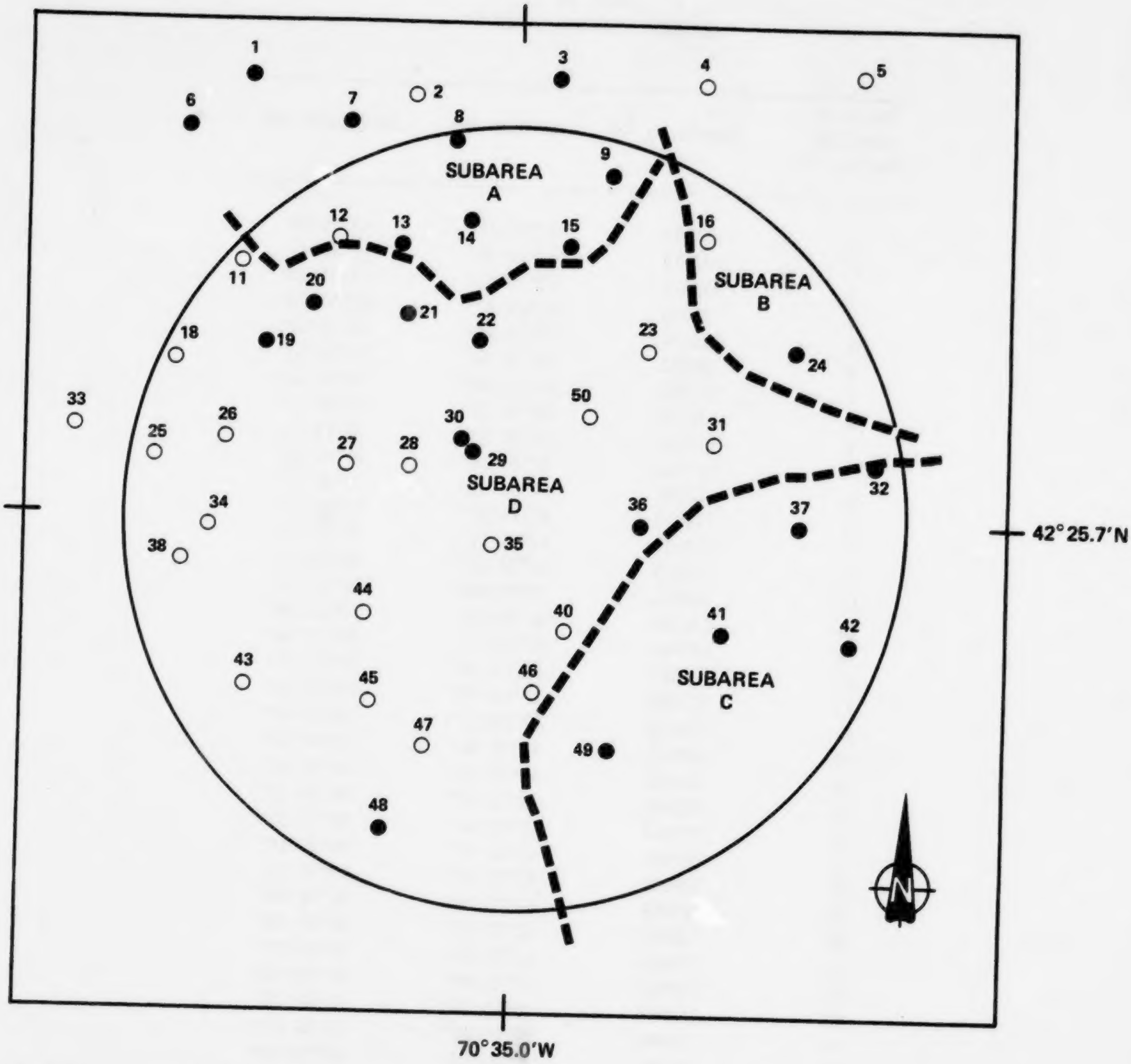
Notes to Table:
(1) Normally not consumed.
* = numerous specimens, not counted.

6.3.1 Area 1 Data

Sediment samples were obtained at 47 locations. Each sample is represented by a small circle in Figure 10. Numbers refer to assigned sampling stations, as shown in the pre-survey plan. The darkened circles identify those 23 samples randomly selected for onboard measurement of radioactivity during the survey. The subareas in Figure 10 are those described previously from the NOAA side scan sonar data, as shown in Figure 4. Table 10 lists the navigational coordinates for each sample obtained.

Completed biota sampling includes 10 lines each of otter trawling and mid-water towing. Each line shown in Figure 11 is a smooth plot for an otter trawl with direction and starting and end points indicated. The number at the starting point of each trawl refers to assigned biota sampling stations. Table 11 provides the navigational coordinates for start and end points of each otter trawl sampling station. Lines of mid-water towing are shown in Figure 12, with direction and depth of towing indicated in feet below surface.

The locations of in-situ radiation measurements and water sampling stations are shown in Figure 13. Navigational coordinates for each event are given in Table 12.



1
2
3
4
5
6
7
8
9
SUBAREA A
12
13
14
15
16
11
20
21
22
SUBAREA B
18
19
23
24
33
50
26
30
31
25
27
28
29
SUBAREA D
32
34
36
37
38
35
42°25.7'N
44
40
41
42
43
46
SUBAREA C
45
47
49
48
N
70°35.0'W

● ONBOARD AND POST-SURVEY ANALYSIS

○ POST-SURVEY ANALYSIS ONLY

FIGURE 10. SEDIMENT SAMPLES, AREA 1, EPA CRUISE – SEPTEMBER 1982

TABLE 10
SEDIMENT SAMPLES, AREA 1

Assigned Sampling Station No.	Sample No.(1)	Latitude (N)	Longitude (W)
1	101081	42°26'48"	70°35'54"
2	102079	42°26'45"	70°35'21"
3	103077	42°26'48"	70°34'53"
4	104075	42°26'47"	70°34'23"
5	105074	42°26'49"	70°33'52"
6	106082	42°26'40"	70°36'07"
7	107080	42°26'41"	70°35'34"
8	108078	42°26'38"	70°35'13"
9	109076	42°26'33"	70°34'42"
11	111065	42°26'19"	70°35'55"
12	112068	42°26'23"	70°35'36"
13	113070	42°26'22"	70°[illegible]5'23"
14	114071	42°26'26"	70°35'10"
15	115072	42°26'22"	70°34'50"
16	116073	42°26'23"	70°34'23"
18	118064	42°26'04"	70°36'08"
19	119066	42°26'07"	70°35'50"
20	120067	42°26'13"	70°35'41"
21	121069	42°26'11"	70°35'22"
22	122058	42°26'07"	70°35'07"
23	123055	42°26'06"	70°34'34"
24	124053	42°26'06"	70°34'04"
25	125063	42°25'49"	70°36'12"
26	126062	42°25'52"	70°35'58"
27	127061	42°25'48"	70°35'34"
28	128060	42°25'46"	70°35'20"
29	129059	42°25'50"	70°35'08"
30	130057	42°25'52"	70°35'10"
31	131054	42°25'52"	70°34'20"
32	132052	42°25'49"	70°33'48"
33	133044	42°25'53"	70°36'28"
34	134045	42°25'38"	70°36'01"
35	135046	42°25'36"	70°35'04"
36	136048	42°25'39"	70°34'35"
37	137051	42°25'39"	70°34'03"
38	138043	42°25'33"	70°36'07"

(Continued)

TABLE 10 (Continued)
SEDIMENT SAMPLES, AREA 1

Assigned Sampling Station No.	Sample No.	Latitude (N)	Longitude (W)
40	140047	42°25'23"	70°34'50"
41	141049	42°25'23"	70°34'18"
42	142050	42°25'21"	70°33'52"
43	143042	42°25'14"	70°35'53"
44	144041	42°25'25"	70°35'30"
45	145040	42°25'12"	70°35'29"
46	146037	42°25'13"	70°34'55"
47	147038	42°25'04"	70°35'17"
48	148039	42°24'52"	70°35'26"
49	149036	42°25'04"	70°34'41"
50	150056	42°25'56"	70°34'46"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

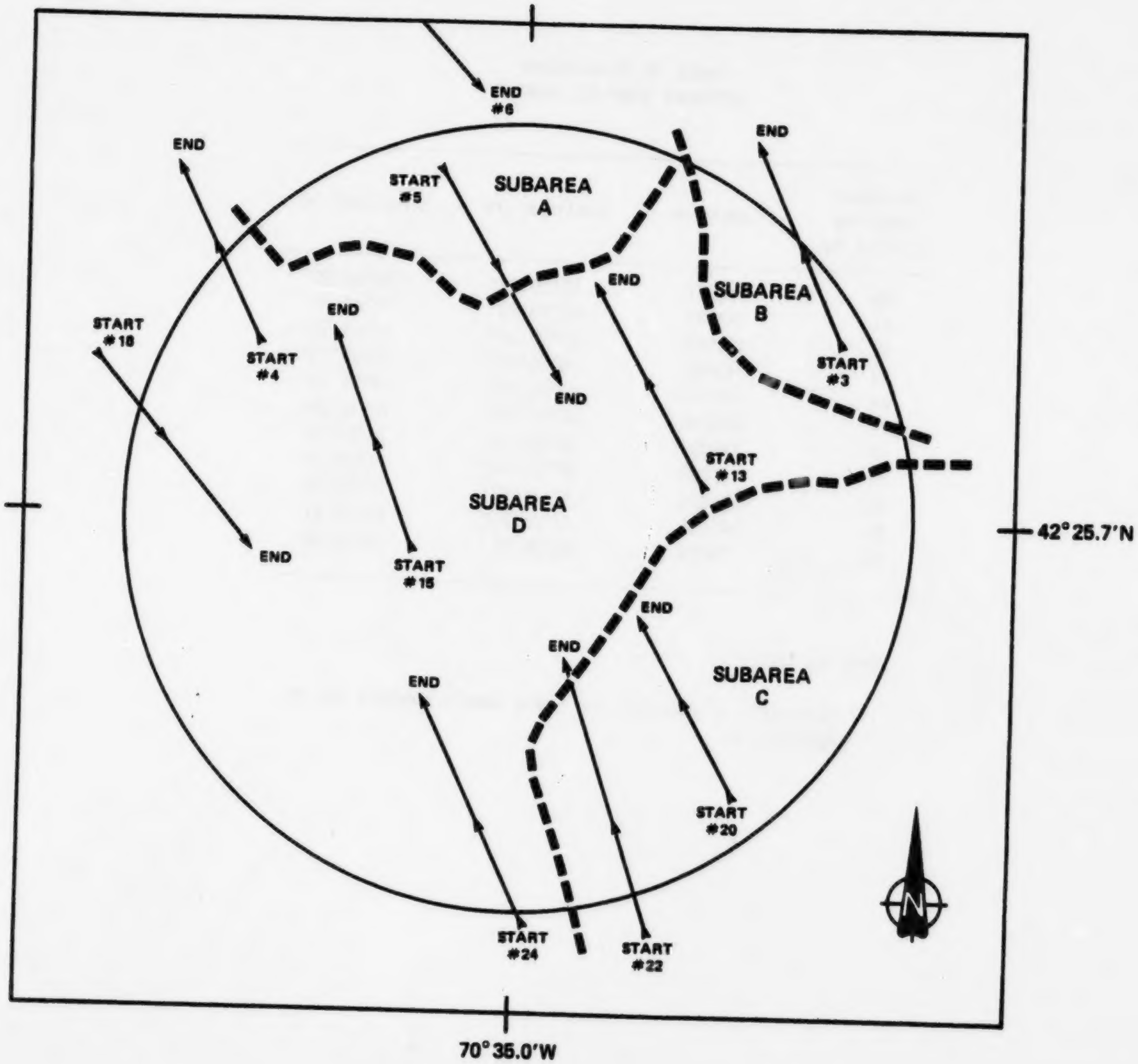

END #6
END
START #5
SUBAREA A
END
SUBAREA B
START #3
START #18
START #4
END
END
END
START #13
SUBAREA D
42°25.7'N
END
START #15
END
END
SUBAREA C
END
START #20
N
START #24
START #22
70°35.0'W

FIGURE 11. LINES OF OTTER TRAWLING, AREA 1, EPA CRUISE – SEPTEMBER 1982

TABLE 11
BIOTA SAMPLING(1), AREA 1 OTTER TRAWL LINES

Assigned Sampling Station No.	Sample No.(1)	Start Latitude (N)	Start Longitude (W)	End Latitude (N)	End Longitude (W)
3	103086	42°26'09"	70°33'58"	42°26'39"	70°34'13"
4	104088	42°26'08"	70°35'53"	42°26'34"	70°36'08"
5	105085	42°26'34"	70°35'16"	42°26'02"	70°34'52"
6	106087	42°27'13"	70°35'34"	42°26'46"	70°35'12"
13	113089	42°25'46"	70°34'27"	42°26'16"	70°34'48"
15	115090	42°25'37"	70°35'22"	42°26'10"	70°35'38"
18	118091	42°26'03"	70°36'24"	42°25'35"	70°35'55"
20	120094	42°24'59"	70°34'17"	42°25'26"	70°34'36"
22	122093	42°24'38"	70°34'32"	42°25'17"	70°34'47"
24	124092	42°25'14"	70°35'19"	42°24'38"	70°34'57"

Note to Table:

(1) Types of biota collected and radionuclide analyses for these sample numbers are in Appendix D.

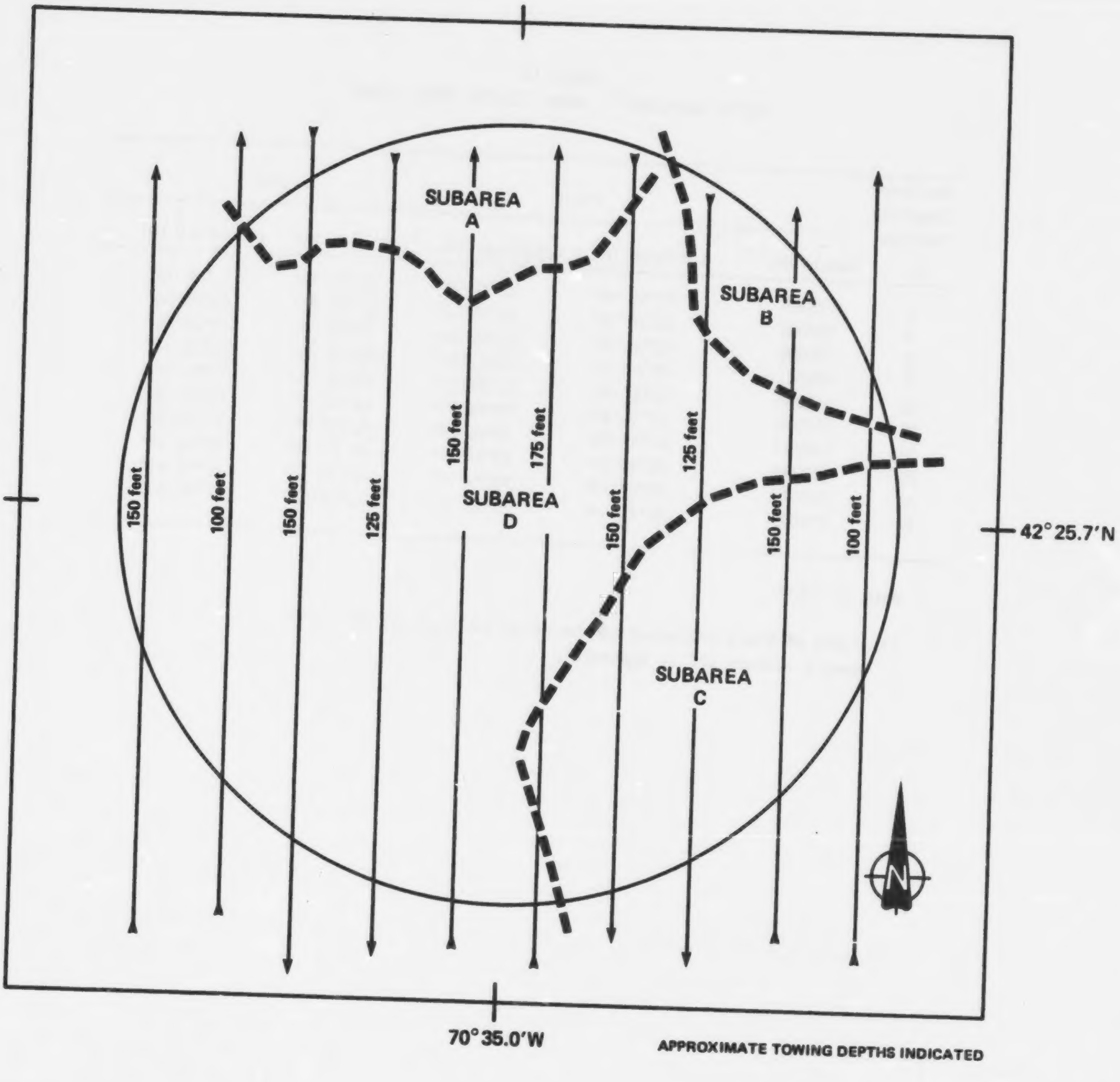

SUBAREA A
SUBAREA B
SUBAREA C
SUBAREA D
150 feet
100 feet
150 feet
125 feet
150 feet
175 feet
150 feet
125 feet
150 feet
100 feet
42° 25.7'N
70° 35.0'W
N
APPROXIMATE TOWING DEPTHS INDICATED

FIGURE 12. LINES OF MID-WATER TOWING, AREA 1, EPA CRUISE – SEPTEMBER 1982

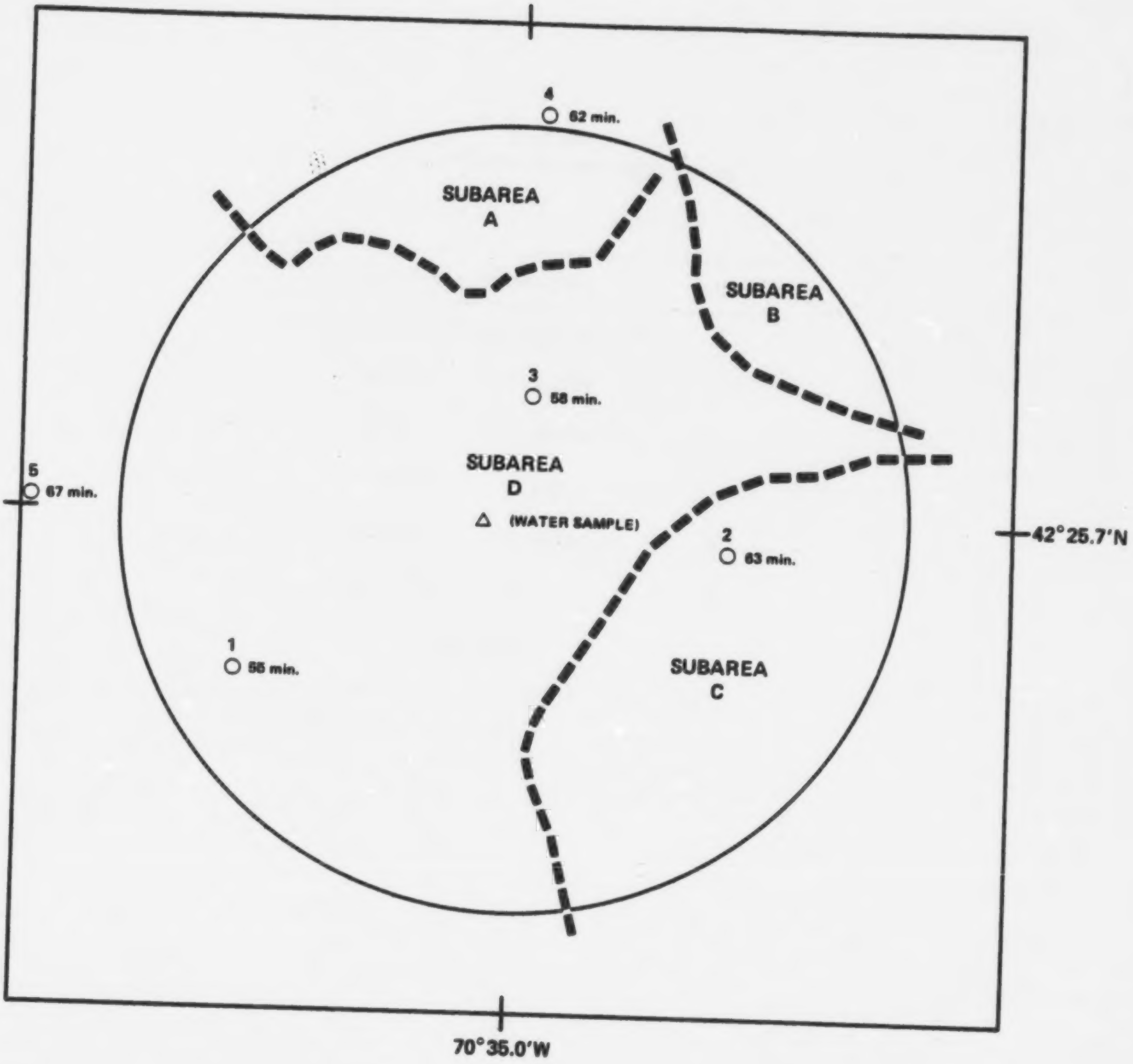

4
62 min.
SUBAREA A
SUBAREA B
3
58 min.
SUBAREA D
5
67 min.
(WATER SAMPLE)
2
63 min.
42°25.7'N
1
55 min.
SUBAREA C
70°35.0'W

FIGURE 13. LOCATION AND DURATION OF IN-SITU RADIATION MEASUREMENTS AREA 1, EPA CRUISE – SEPTEMBER 1982

TABLE 12
AREA 1 LOCATIONS FOR ADDITIONAL DATA

Number	Latitude (N)	Longitude (W)
	In-situ Radiation Measurements	
1	42°25'15"	70°35'56"
2	42°25'37"	70°34'18"
3	42°25'59"	70°34'59"
4	42°26'44"	70°34'58"
5	42°25'40"	70°36'43"
	Water Sample	
	42°25'41"	70°35'04"

6.3.2 Area 2 Data

Sediment samples were obtained at 24 locations. Each sample is represented by a small circle in Figure 14. Numbers refer to assigned sampling stations, as shown in the pre-survey plan. The darkened circles identify those 11 samples randomly selected for onboard measurement of radioactivity during the survey. Data from the NOAA side scan sonar survey, as previously shown in Figure 5, are also presented. Table 13 lists the navigational coordinates of sampling.

Completed biota sampling includes seven lines of otter trawling and three lines of mid-water towing. Their locations are shown in Figures 15 and 16, respectively. Sampling information is presented in the same format used for Area 1 sampling information. Table 14 provides navigational coordinates for otter trawl lines.

The information presented in Figure 17 and Table 15 is for water sampling and in-situ radiation measurements. No underwater television surveying was attempted in this area because the system was inoperable at that time.

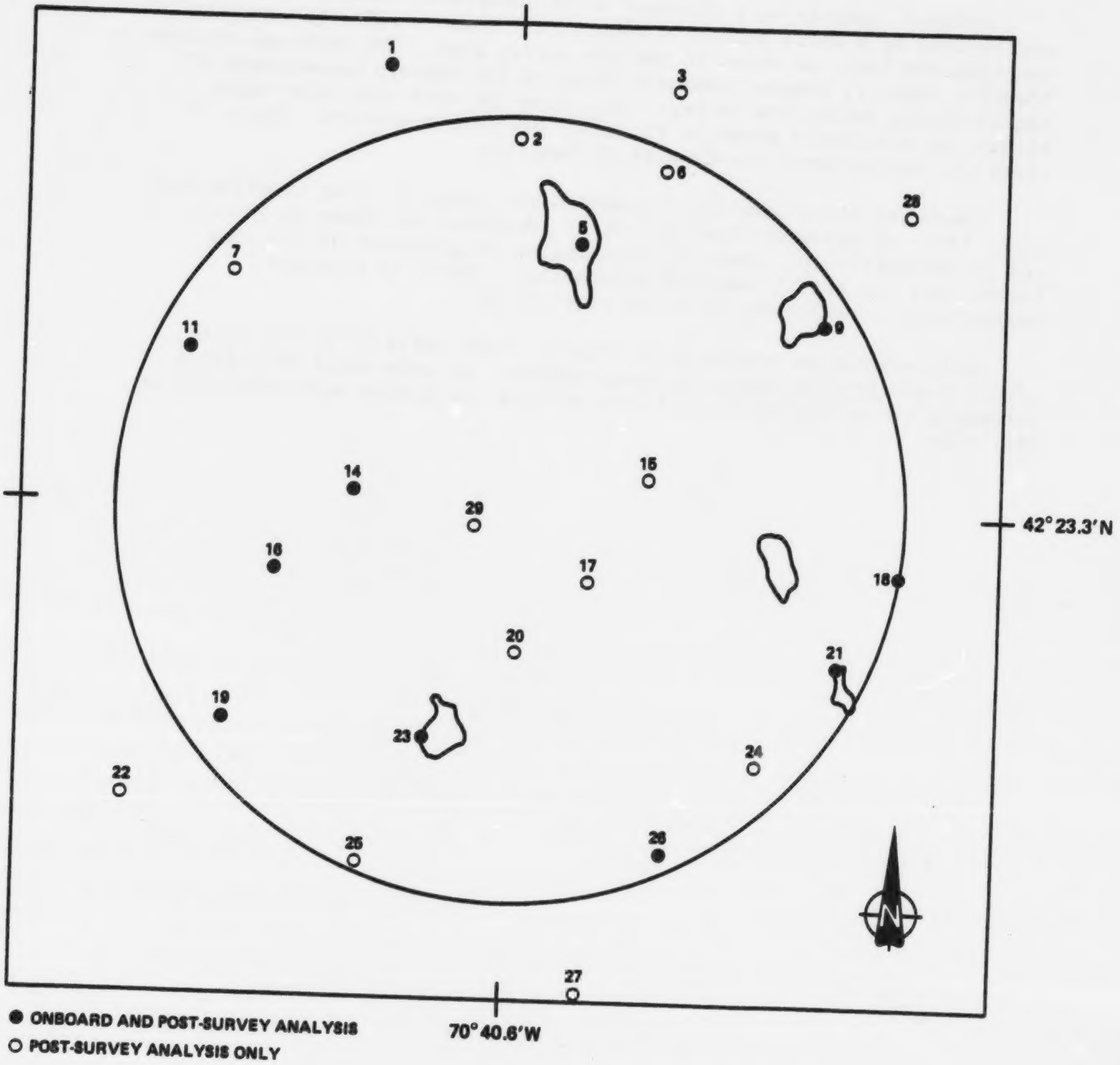

1
3
2
6
28
5
7
11
9
14
15
29
42° 23.3' N
16
17
18
20
21
19
23
22
24
26
25
N
27
70° 40.6' W
● ONBOARD AND POST-SURVEY ANALYSIS
○ POST-SURVEY ANALYSIS ONLY

FIGURE 14. SEDIMENT SAMPLES, AREA 2, EPA CRUISE – SEPTEMBER 1982

TABLE 13
SEDIMENT SAMPLES, AREA 2

Assigned Sampling Station No.	Sample No.(1)	Latitude (N)	Longitude (W)
1	201117	42°24'28"	70°41'01"
2	202125	42°24'16"	70°40'36"
3	203126	42°24'23"	70°40'05"
5	205124	42°24'01"	70°40'25"
6	206127	42°24'11"	70°40'07"
7	207118	42°23'56"	70°41'31"
9	209129	42°23'49"	70°39'35"
11	211119	42°25'44"	70°41'40"
14	214123	42°23'22"	70°41'08"
15	215130	42°23'23"	70°40'08"
16	216122	42°23'10"	70°41'23"
17	217131	42°23'07"	70°40'20"
18	218140	42°23'08"	70°39'19"
19	219121	42°22'46"	70°41'34"
20	220133	42°22'51"	70°40'34"
21	221139	42°22'54"	70°39'31"
22	222120	42°22'35"	70°41'53"
23	223134	42°22'42"	70°40'54"
24	224138	42°22'38"	70°39'47"
25	225135	42°22'24"	70°41'08"
26	226137	42°22'25"	70°40'05"
27	227136	42°22'02"	70°40'20"
28	228128	42°24'05"	70°39'20"
29	229132	42°23'15"	70°40'43"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

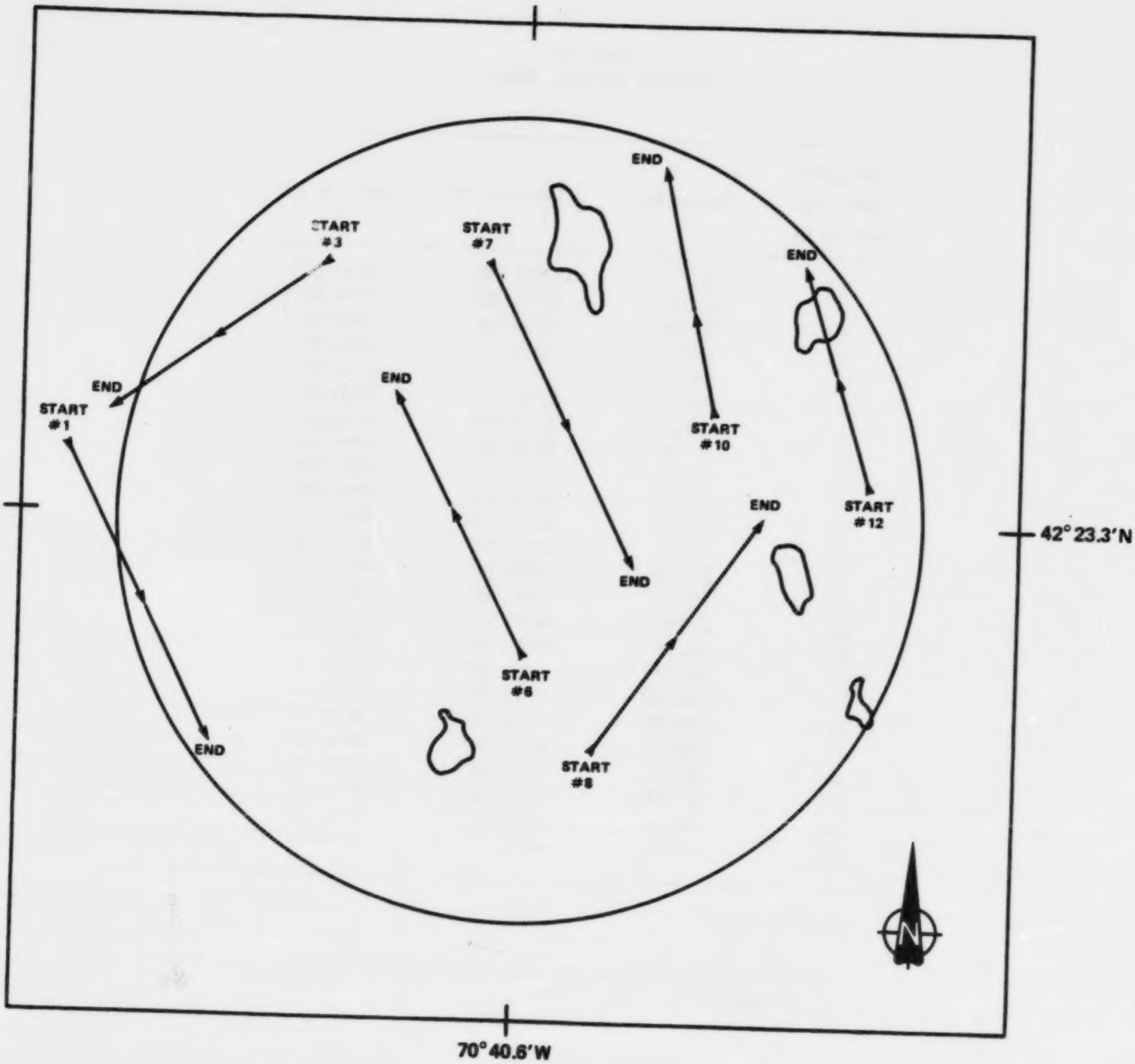

END
START
#3
START
#7
END
END
END
START
#1
END
START
#10
END
START
#12
42° 23.3'N
END
START
#6
END
START
#8
N
70° 40.6'W

FIGURE 15. OTTER TRAWL LINES, AREA 2, EPA CRUISE – SEPTEMBER 1982

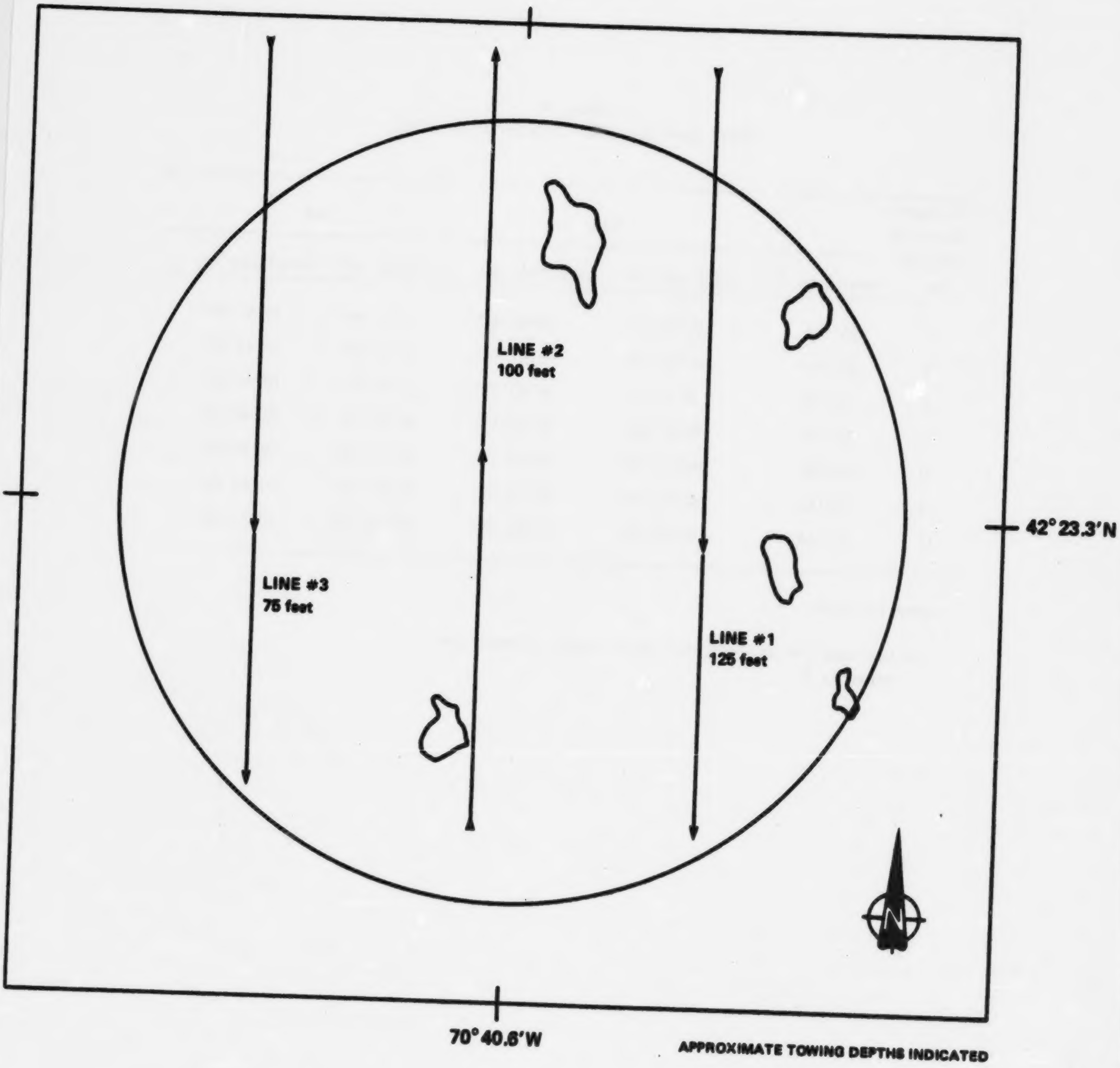

LINE #2
100 feet
LINE #3
75 feet
LINE #1
125 feet
42° 23.3'N
70° 40.6'W
N
APPROXIMATE TOWING DEPTHS INDICATED

FIGURE 16. LINES OF MID-WATER TOWING, AREA 2, EPA CRUISE – SEPTEMBER 1982

TABLE 14
BIOTA SAMPLING, AREA 2 OTTER TRAWL LINES

Assigned Sampling Station No.	Sample No.[1]	Start Latitude (N)	Start Longitude (W)	End Latitude (N)	End Longitude (W)
1	201147	42°23'25"	70°42'02"	42°22'44"	70°41'35"
3	203143	42°23'59"	70°41'15"	42°23'35"	70°41'59"
6	206146	42°22'52"	70°40'35"	42°23'32"	70°40'53"
7	207145	42°23'52"	70°40'44"	42°23'14"	70°40'18"
8	208148	42°22'45"	70°40'19"	42°23'20"	70°39'49"
10	210142	42°23'38"	70°39'57"	42°24'16"	70°40'08"
12	212144	42°23'25"	70°39'28"	42°23'50"	70°39'38"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

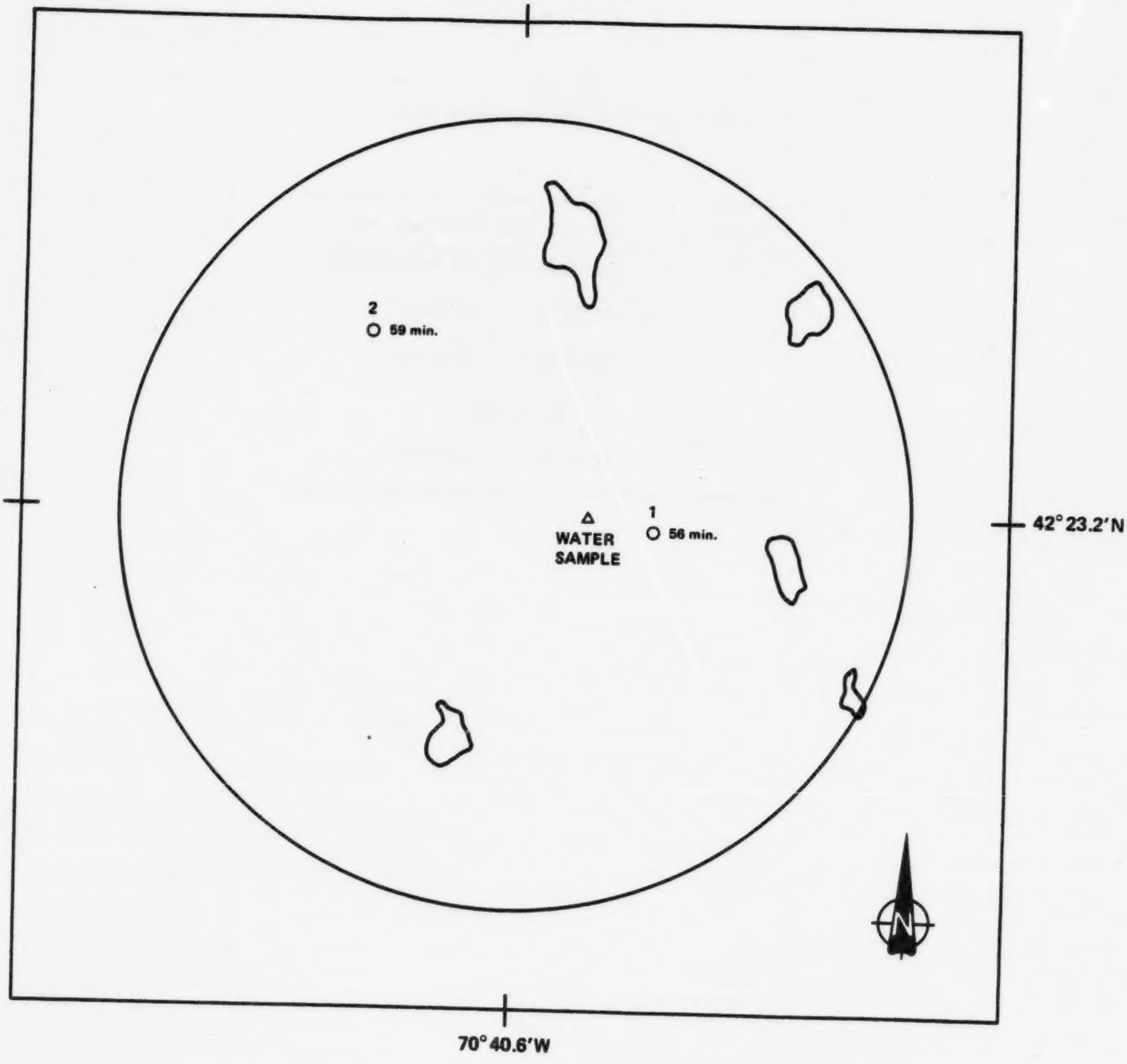

2
59 min.
1
56 min.
WATER
SAMPLE
42° 23.2'N
70° 40.6'W
N

FIGURE 17. LOCATIONS AND DURATIONS OF IN-SITU RADIATION MEASUREMENTS AREA 2, EPA CRUISE – SEPTEMBER 1982

TABLE 15
AREA 2 LOCATIONS FOR ADDITIONAL DATA

Number	Latitude (N)	Longitude (W)
	In-situ Radiation Measurements	
1	42°23'15"	70°40'05"
2	42°23'46"	70°41'04"
	Water Sample	
	42°23'16"	70°40'20"

6.3.3 Area 3 Data

Sediment samples were obtained at 16 locations. Each sample is represented by a small circle in Figure 18. Numbers refer to the assigned, pre-survey sampling stations. The darkened circles identify those 11 samples randomly selected for onboard radioactivity measurement. The location of sediment sampling is shown in relation to the data obtained during the NOAA side scan sonar survey, as shown in Figure 6. Table 16 lists the navigational coordinates for each sample obtained.

Completed biota sampling includes five lines each of otter trawling and mid-water towing. Their locations are shown in Figures 19 and 20, respectively. Sampling information is presented as done previously for areas 1 and 2. Table 17 gives the navigational sampling coordinates for otter trawl lines.

Figure 21 and Table 18 show the locations of water sampling and in-situ radiation measurements, respectively. No underwater television surveying was attempted in this area because the system was inoperable at that time.

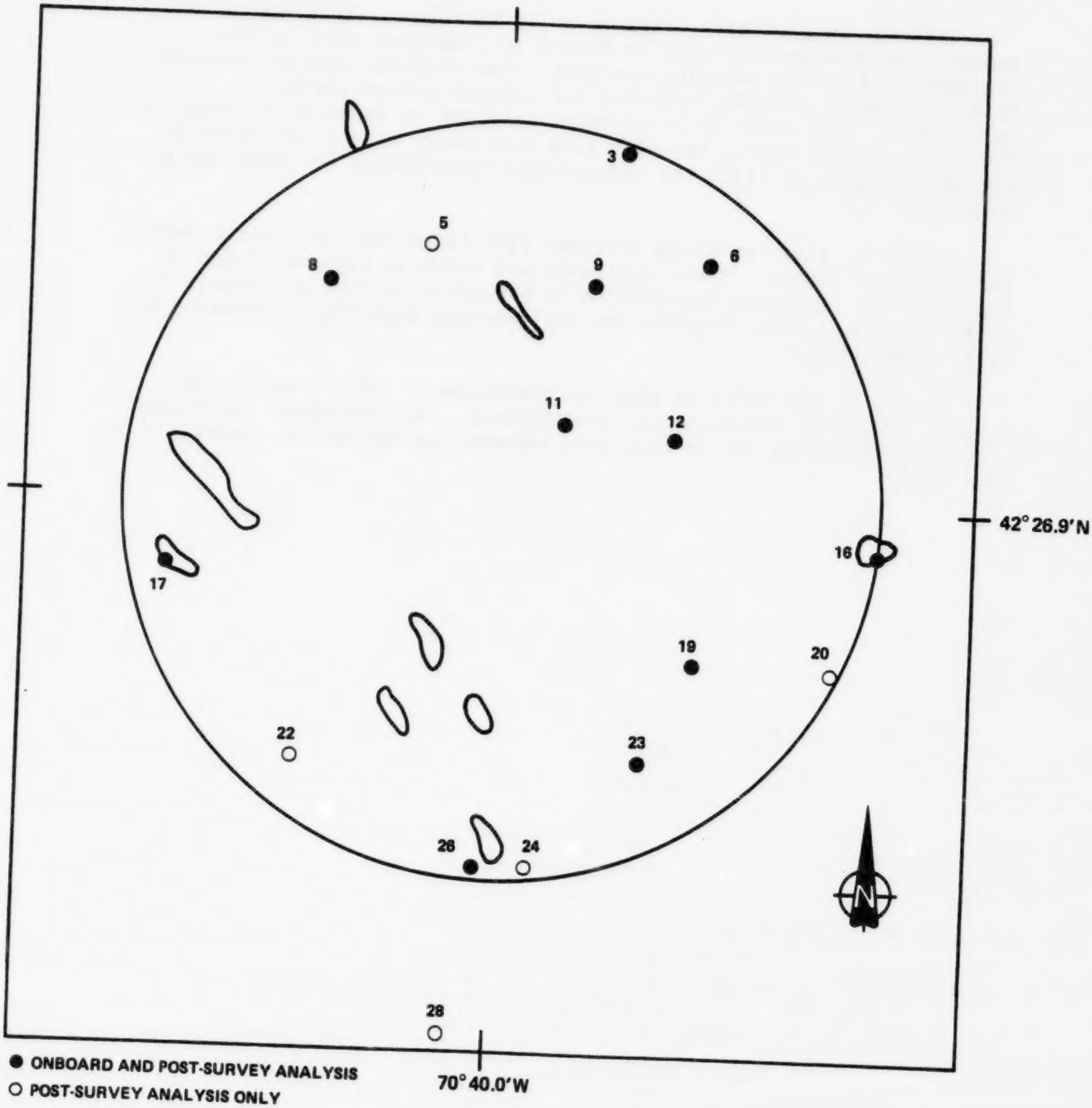

3
5
8
9
6
11
12
42° 26.9'N
16
17
19
20
22
23
26
24
N
28
70° 40.0'W
● ONBOARD AND POST-SURVEY ANALYSIS
○ POST-SURVEY ANALYSIS ONLY

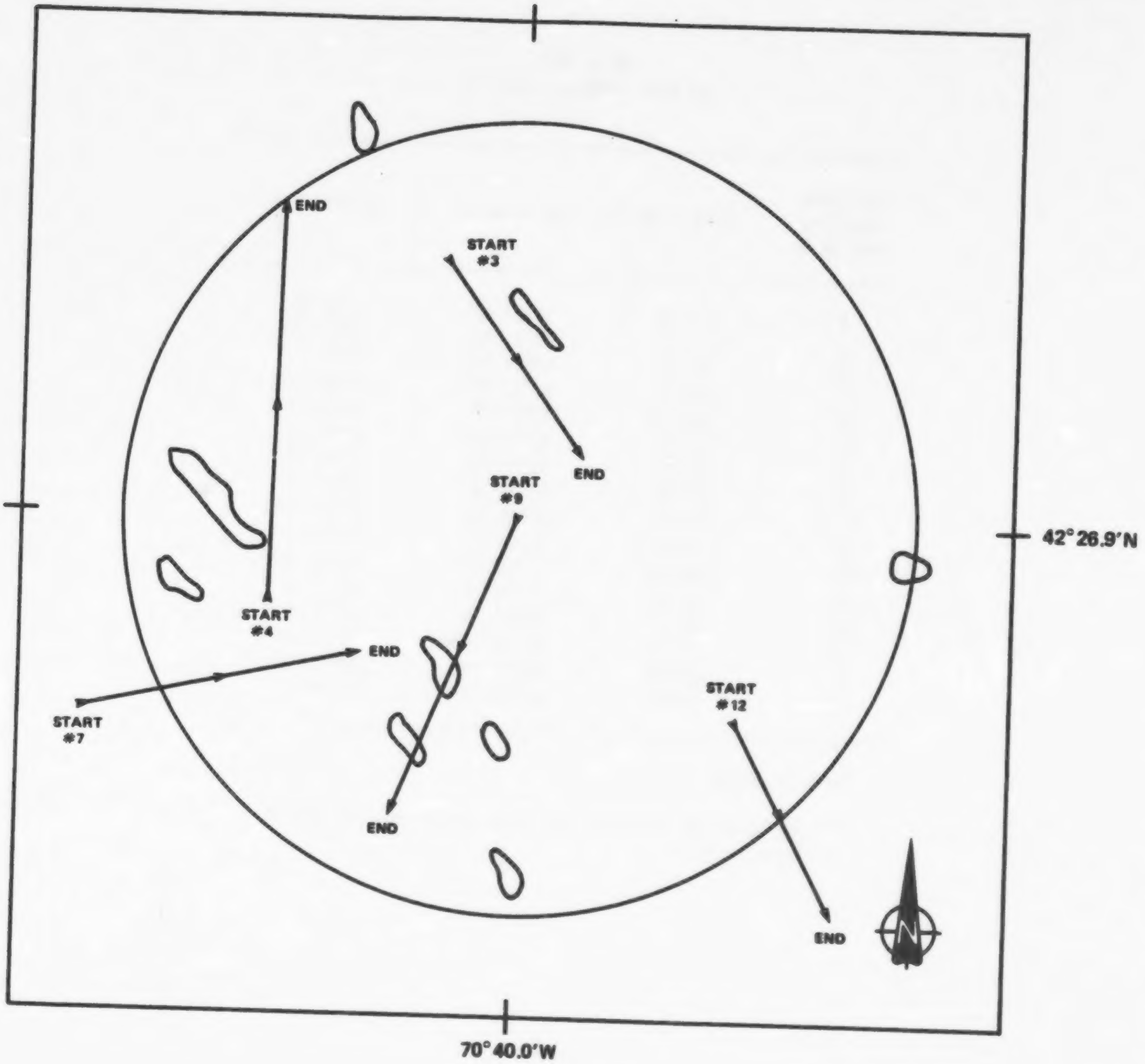
FIGURE 18. SEDIMENT SAMPLES, AREA 3, EPA CRUISE – SEPTEMBER 1982

TABLE 16
SEDIMENT SAMPLES, AREA 3

Assigned Sampling Station No.	Sample No.(1)	Latitude (N)	Longitude (W)
3	303116	42°27'48"	70°39'35"
5	305113	42°27'33"	70°40'16"
6	306115	42°27'32"	70°39'16"
8	308112	42°27'28"	70°40'37"
9	309114	42°27'28"	70°39'41"
11	311111	42°27'07"	70°39'46"
12	312105	42°27'05"	70°39'23"
16	316097	42°26'48"	70°38'37"
17	317104	42°26'43"	70°41'10"
19	319098	42°26'31"	70°39'17"
20	320096	42°26'30"	70°38'48"
22	322103	42°26'15"	70°40'42"
23	323099	42°26'16"	70°39'28"
24	324100	42°25'59"	70°39'51"
26	326102	42°25'59"	70°40'02"
28	328101	42°25'31"	70°40'08"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.



START
#3
END
START
#4
END
START
#9
END
START
#7
END
START
#12
END
N
42°26.9'N
70°40.0'W

FIGURE 19. LINES OF OTTER TRAWLING, AREA 3, EPA CRUISE – SEPTEMBER 1982

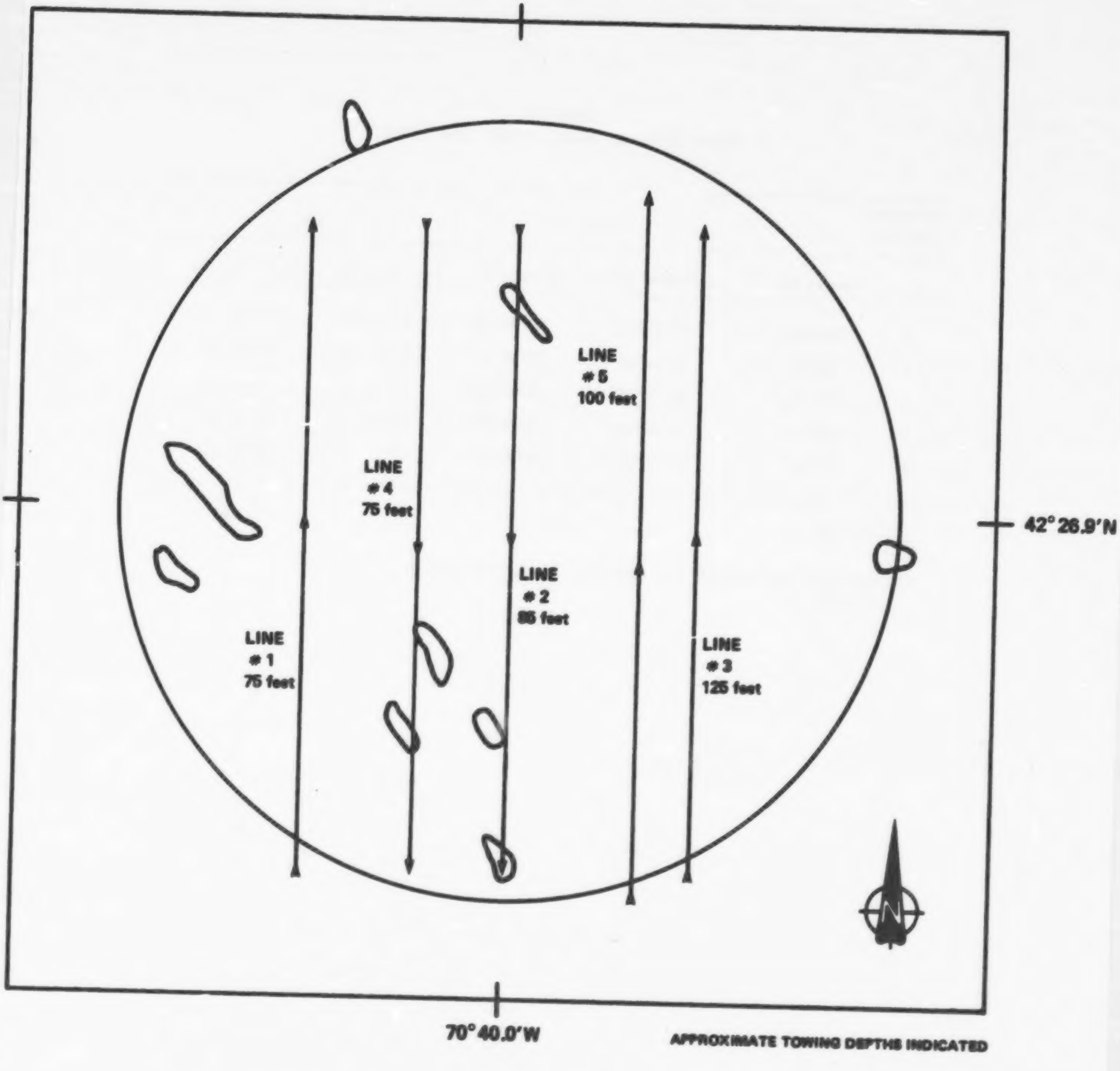

LINE # 5 100 feet
LINE # 4 75 feet
LINE # 2 85 feet
LINE # 1 75 feet
LINE # 3 125 feet
42° 26.9'N
70° 40.0'W
N
APPROXIMATE TOWING DEPTHS INDICATED

FIGURE 20. LINES OF MID-WATER TOWING, AREA 3, EPA CRUISE – SEPTEMBER 1982

TABLE 17
BIOTA SAMPLING, AREA 3 OTTER TRAWL LINES

Assigned Sampling Station	Start			End	
No.	Sample No.(1)	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)
3	303109	42°27'31"	70°40'14"	42°27'03"	70°39'47"
4	304150	42°26'40"	70°40'51"	42°27'39"	70°40'49"
7	307108	42°26'20"	70°41'56"	42°26'34"	70°40'32"
9	309151	42°26'56"	70°40'01"	42°26'11"	70°40'25"
12	312107	42°26'25"	70°39'13"	42°25'58"	70°38'49"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

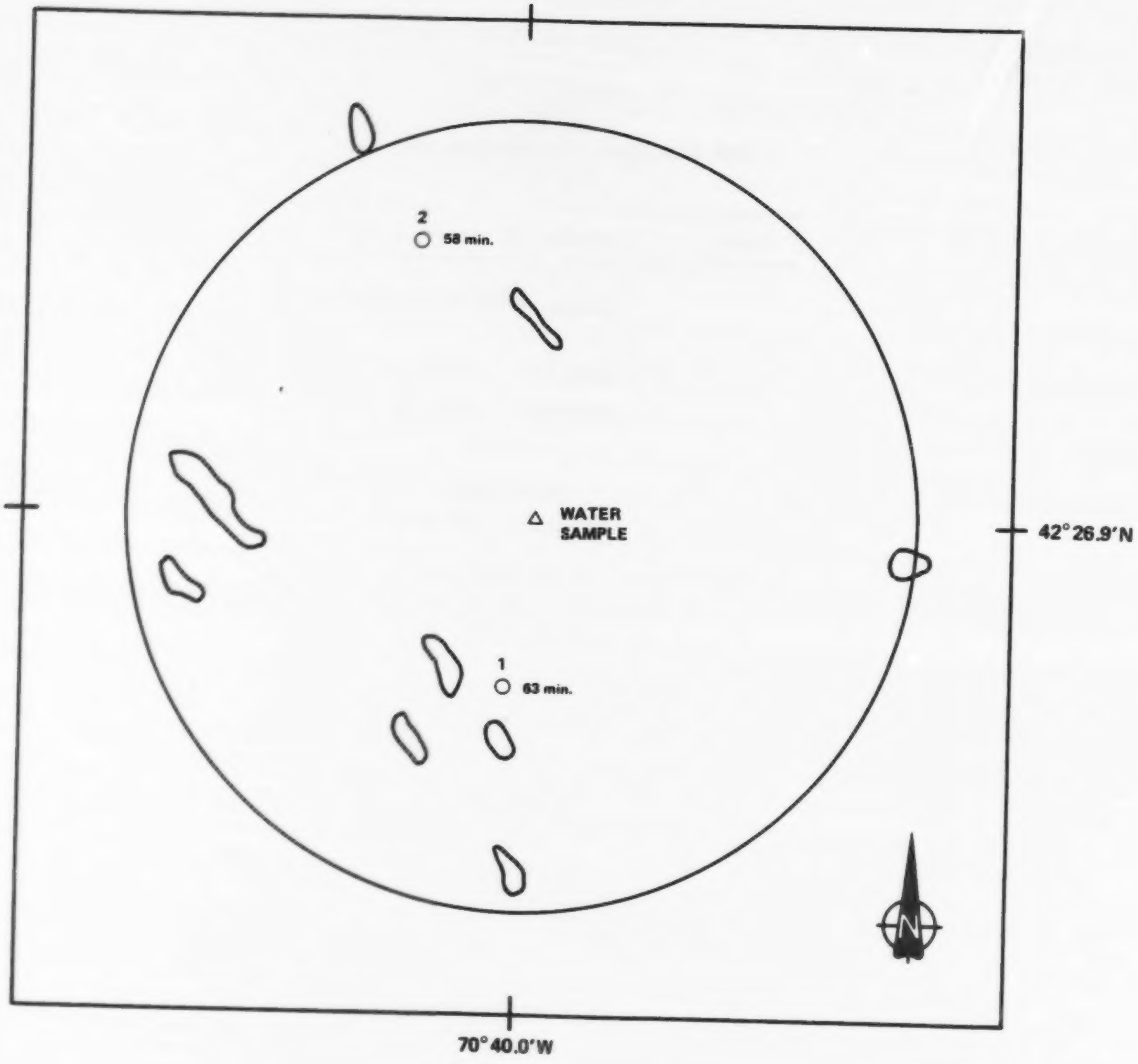

2
58 min.
WATER SAMPLE
1
63 min.
42°26.9'N
70°40.0'W
N

FIGURE 21. LOCATIONS AND DURATIONS OF IN-SITU RADIATION MEASUREMENTS AREA 3, EPA CRUISE – SEPTEMBER 1982

TABLE 18
AREA 3 LOCATIONS FOR ADDITIONAL DATA

Number	Latitude (N)	Longitude (W)
	In-situ Radiation Measurements	
1	42°26'31"	70°40'02"
2	42°27'38"	70°40'23"
	Water Sample	
	42°26'54"	70°39'56"

6.3.4 Area 4 Data

Area 4 was surveyed first. This was done for two reasons: (a) to insure that all equipment and instruments were working properly; and (b) to acquire reference data needed by some of the instruments for direct comparison with measurements to be made later in disposal areas. In addition, surveying a control site in this area was needed because of limited data available in the literature for ambient data. Thus, the data from the control site would be important to evaluating data from disposal sites.

Side scan sonar data was initially collected to determine the suitability of this area as a reference. There was no evidence to indicate that waste disposals had taken place in this area. The locations of side scanning lines are shown in Figure 22; coordinates are provided in Table 19. Figure 23 and Table 20 provide information for water sampling and the measurement of in-situ radioactivity, which was done to acquire ambient radiation data for comparison to measurements in the disposal areas.

Sediment samples were obtained at 26 locations, each of which is represented by a small circle in Figure 24. Numbers refer to the assigned, pre-survey sampling stations. The darkened circles identify those 17 samples that were randomly selected for radioanalysis during the survey. The coordinates for each sample are given in Table 21.

Seven benthic biota trawls and three mid-water tow lines were completed. Smooth plots for each otter trawl station and mid-water tow are given in Figures 25 and 26, respectively. Navigational coordinates for otter trawl lines are provided in Table 22.

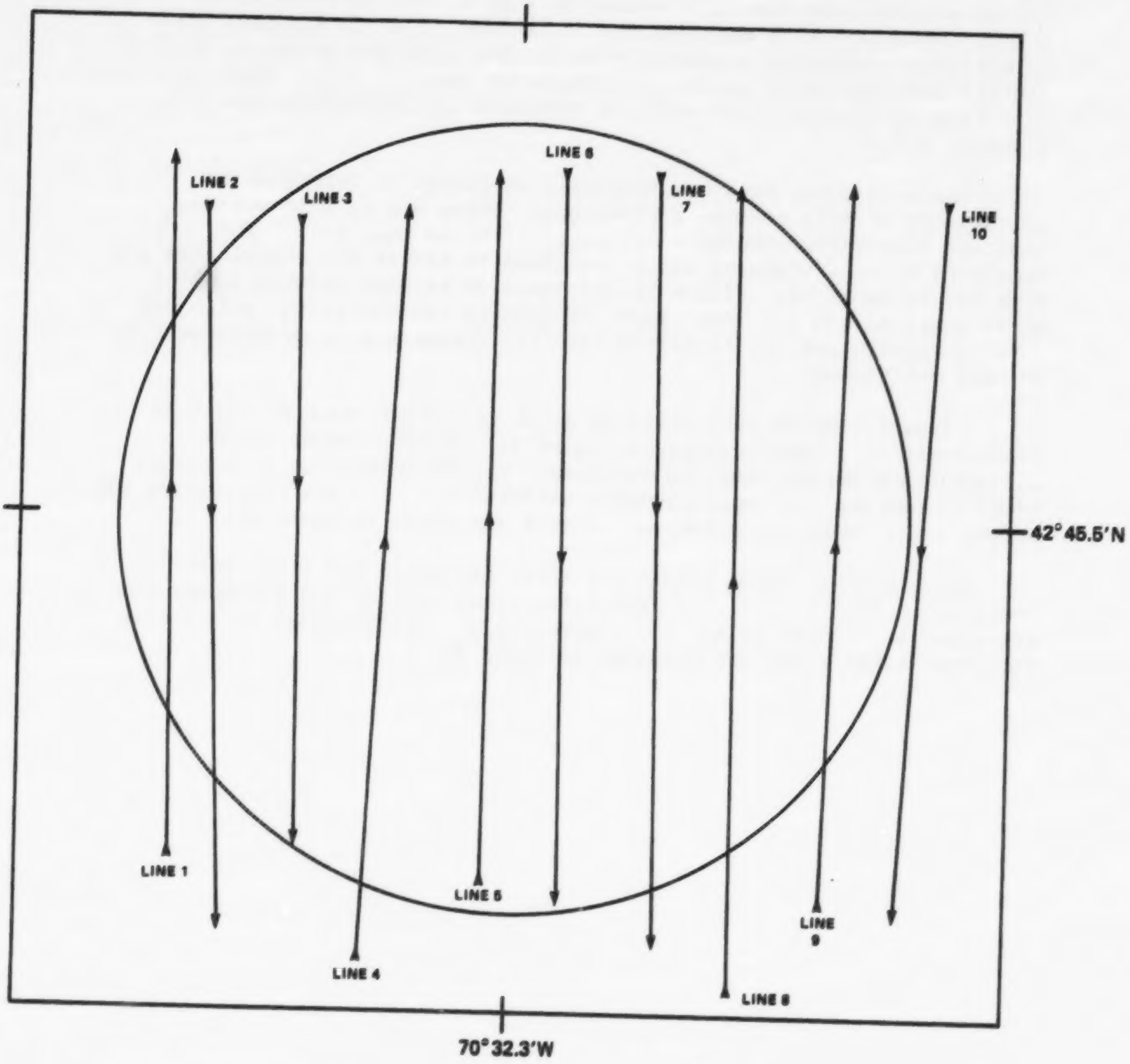

LINE 1
LINE 2
LINE 3
LINE 4
LINE 5
LINE 6
LINE 7
LINE 8
LINE 9
LINE 10
42° 45.5'N
70° 32.3'W

FIGURE 22. SIDE SCAN SONAR LINES, AREA 4, EPA CRUISE – SEPTEMBER 1982

TABLE 19
SIDE SCAN SONAR LINES, AREA 4

Line No.	Start		End	
	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)
1	42°44'38"	70°33'17"	42°46'25"	70°33'19"
2	42°46'16"	70°33'13"	42°44'28"	70°33'08"
3	42°46'15"	70°32'52"	42°44'40"	70°32'50"
4	42°44'23"	70°32'44"	42°46'17"	70°32'38"
5	42°44'35"	70°32'22"	42°46'23"	70°32'22"
6	42°46'22"	70°32'11"	42°44'31"	70°32'09"
7	42°46'23"	70°31'55"	42°44'26"	70°31'53"
8	42°44'19"	70°31'39"	42°46'20"	70°31'41"
9	42°44'32"	70°31'24"	42°46'20"	70°31'21"
10	42°46'18"	70°31'05"	42°44'30"	70°31'11"

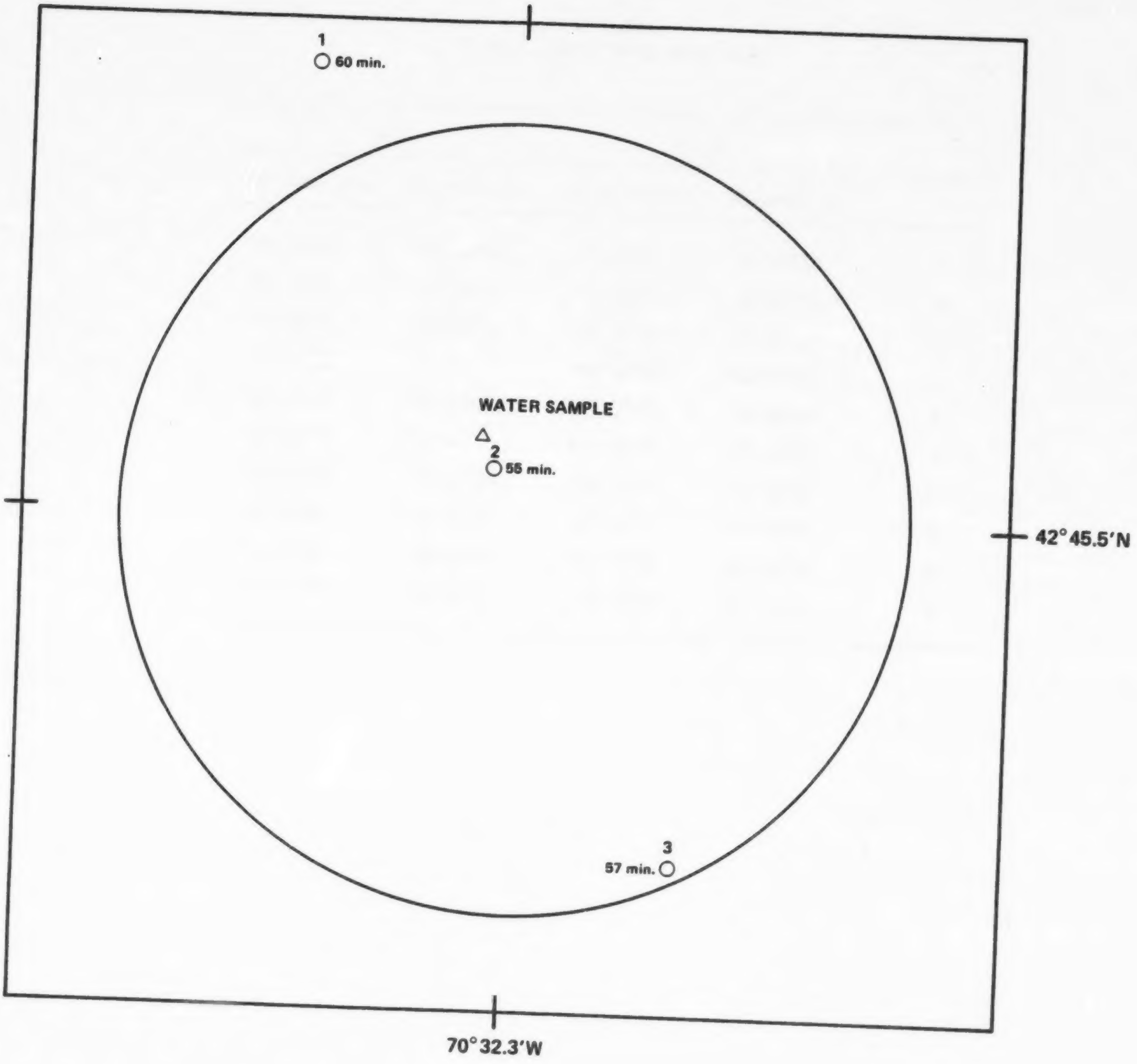
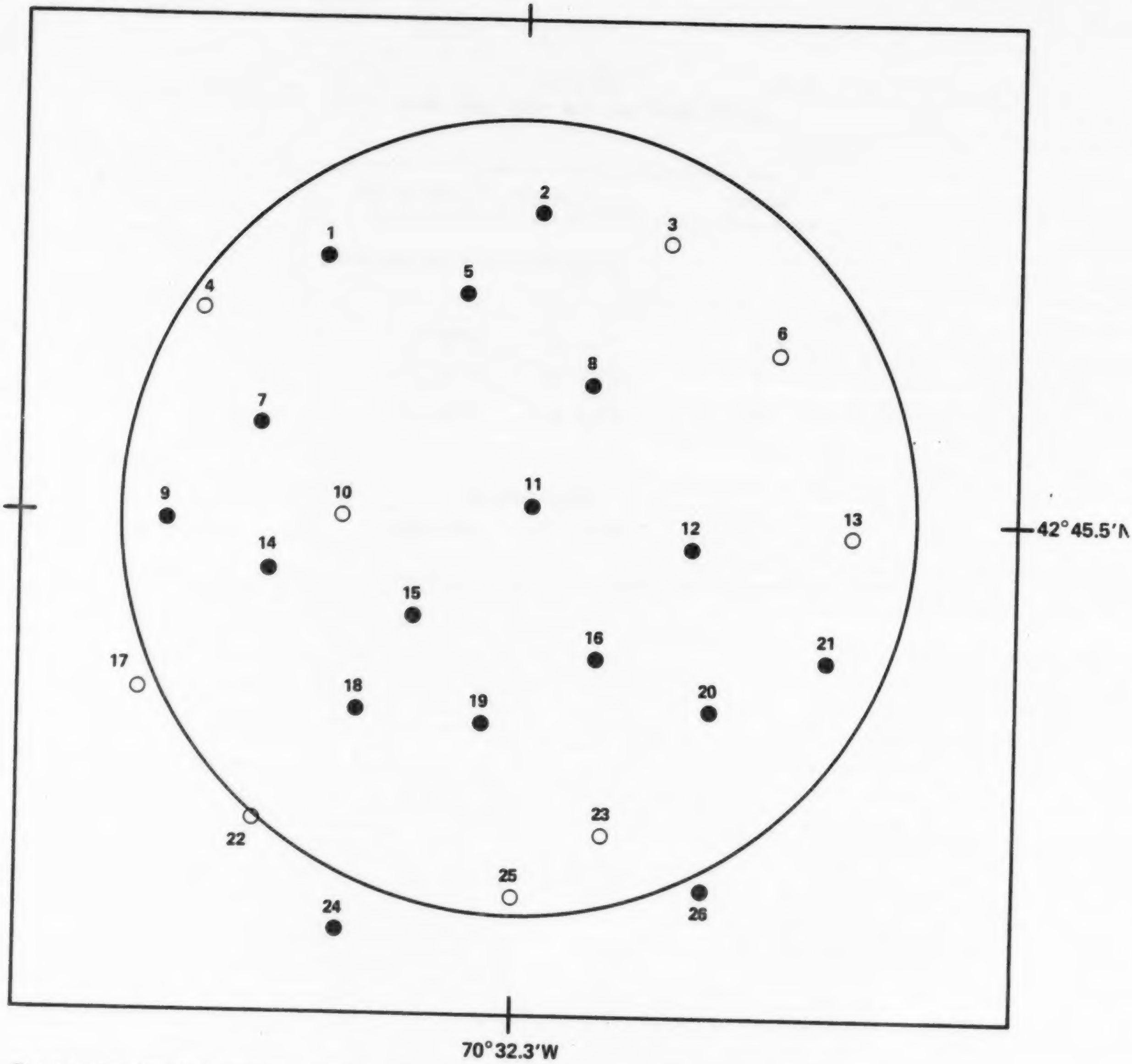

1
60 min.
WATER SAMPLE
2
55 min.
3
57 min.
42° 45.5′N
70° 32.3′W

FIGURE 23. LOCATIONS AND DURATIONS OF IN-SITU RADIATION MEASUREMENTS AREA 4, EPA CRUISE – SEPTEMBER 1982

TABLE 20
AREA 4 LOCATIONS FOR ADDITIONAL DATA

Number	Latitude (N)	Longitude (W)
	In-situ Radiation Measurements	
1	42°26'39"	70°32'55"
2	42°45'38"	70°32'21"
3	42°44'37"	70°31'49"
	Water Sample	
	42°25'43"	70°32'25"


1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
42° 45.5'N
70° 32.3'W

● ONBOARD AND POST-SURVEY ANALYSIS
○ POST-SURVEY ANALYSIS ONLY

FIGURE 24. SEDIMENT SAMPLES, AREA 4, EPA CRUISE – SEPTEMBER 1982

TABLE 21
SEDIMENT SAMPLES, AREA 4

Assigned Sampling Station No.	Sample No.(1)	Latitude (N)	Longitude (W)
1	401012	42°46'10"	70°32'53"
2	402014	42°46'16"	70°32'16"
3	403015	42°46'12"	70°31'54"
4	404011	42°46'01"	70°33'14"
5	405013	42°46'04"	70°32'29"
6	406016	42°45'55"	70°31'35"
7	407001	42°45'44"	70°33'04"
8	408019	42°45'32"	70°32'17"
9	409022	42°45'29"	70°33'20"
10	410021	42°45'30"	70°32'50"
11	411020	42°45'32"	70°32'16"
12	412018	42°45'26"	70°31'50"
13	413017	42°45'28"	70°31'22"
14	414002	42°45'22"	70°33'02"
15	415026	42°45'15"	70°32'37"
16	416028	42°44'57"	70°32'20"
17	417023	42°45'03"	70°33'22"
18	418025	42°45'01"	70°32'46"
19	419027	42°44'59"	70°32'25"
20	420029	42°45'01"	70°31'46"
21	421030	42°45'09"	70°31'26"
22	422024	42°44'44"	70°33'04"
23	423032	42°44'42"	70°32'04"
24	424034	42°44'27"	70°32'49"
25	425033	42°44'25"	70°32'11"
26	426031	42°44'34"	70°31'47"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

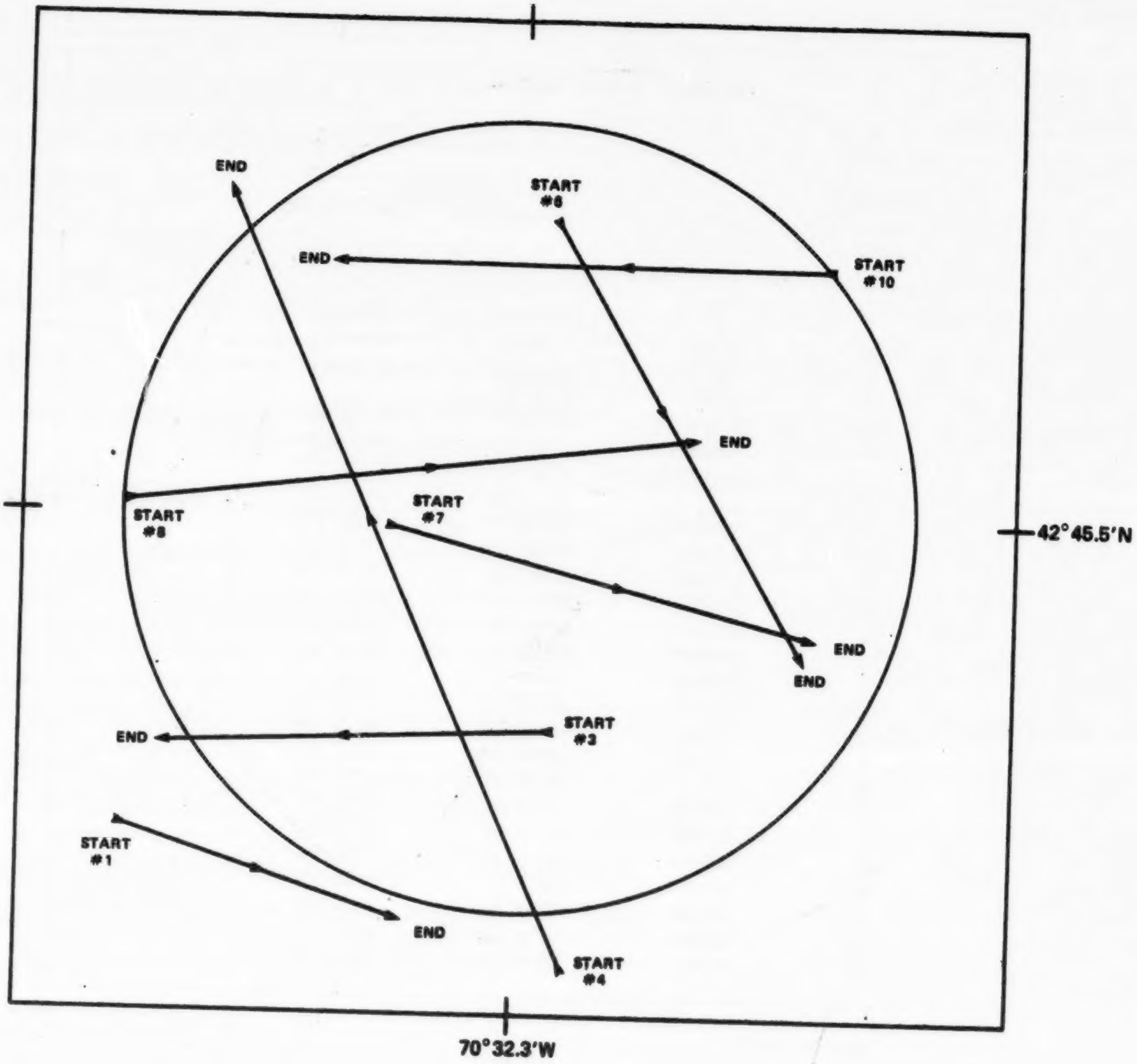

END
START
#6
END
START
#10
END
START
#8
START
#7
42°45.5'N
END
END
END
START
#3
START
#1
END
START
#4
70°32.3'W

FIGURE 25. LINES OF OTTER TRAWLING, AREA 4, EPA CRUISE – SEPTEMBER 1982

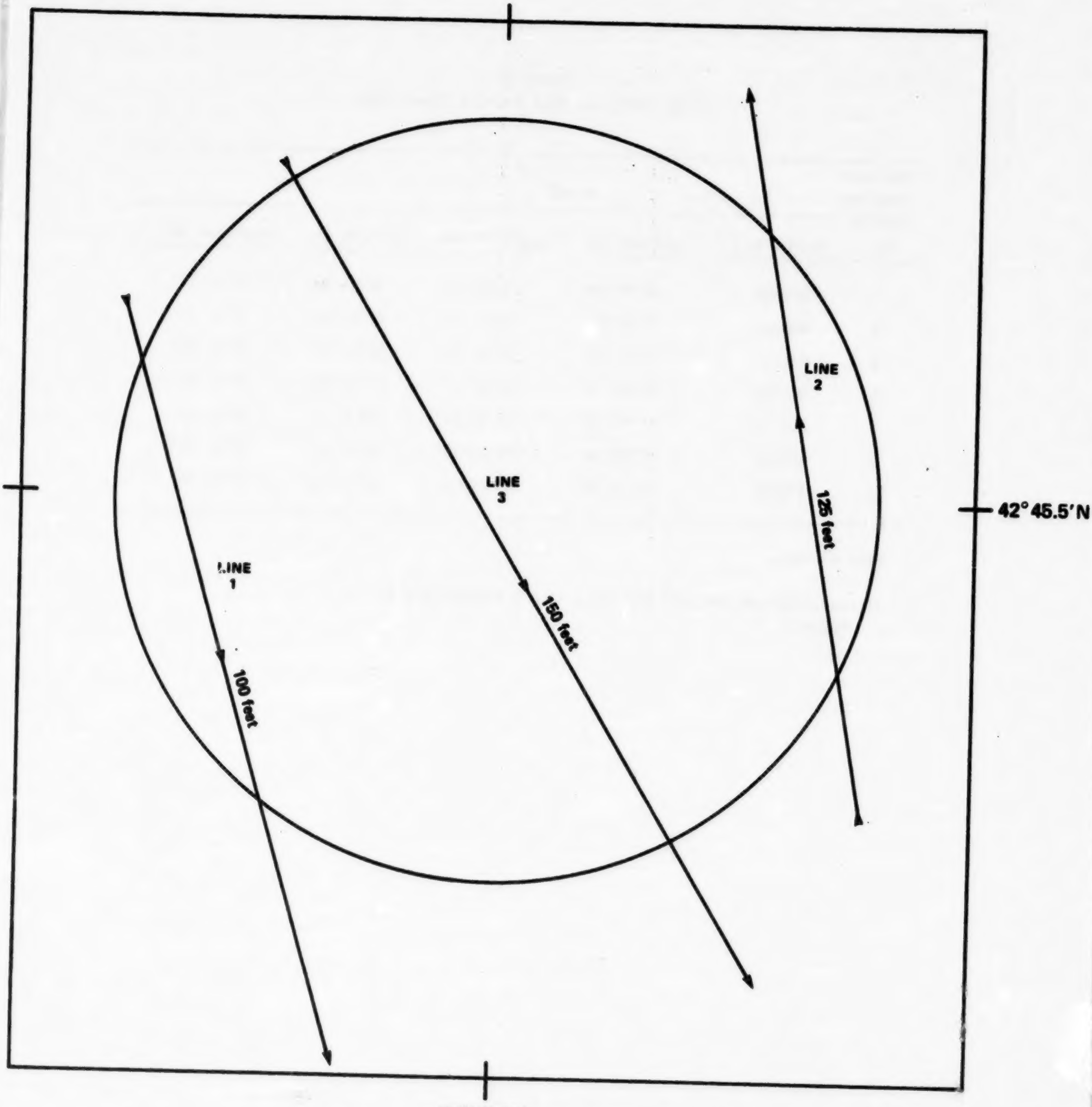

42° 45.5′N
70° 32.2′W
LINE 1
100 feet
LINE 2
125 feet
LINE 3
150 feet
APPROXIMATE TOWING DEPTHS INDICATED

FIGURE 26. LINES OF MID-WATER TOWING, AREA 4
EPA SURVEY – SEPTEMBER 1982

TABLE 22
BIOTA SAMPLING, AREA 4 OTTER TRAWL LINES

Assigned Sampling Station		Start		End	
No.	Sample No.(1)	Latitude (N)	Longitude (W)	Latitude (N)	Longitude (W)
1	401003	42°44'44"	70°33'25"	42°44'30"	70°32'57"
3	403004	42°44'59"	70°32'14"	42°44'56"	70°33'18"
4	404010	42°44'23"	70°32'10"	42°46'20"	70°33'09"
6	406152	42°46'17"	70°32'13"	42°45'10"	70°31'27"
7	407153	42°45'29"	70°32'43"	42°45'13"	70°31'25"
8	408005	42°45'33"	70°33'25"	42°45'43"	70°31'49"
10	410006	42°46'09"	70°31'29"	42°46'10"	70°32'50"

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

6.3.5 Area 5 Data

Surveying in this area was to begin after completion of survey work in areas 1, 2, 3, and 4. Upon arrival in Area 5, the ANTELOPE encountered extremely bad weather conditions, allowing completion of only two sediment samples and one successful otter trawl. The locations and navigational coordinates for sampling completed are given in Figure 27 and Table 23.

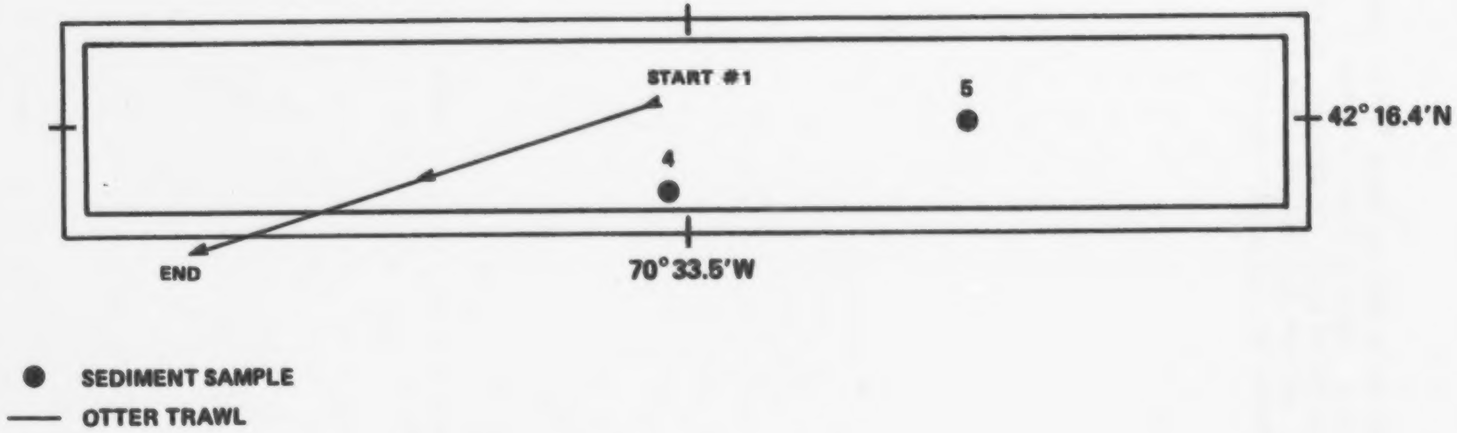

START #1
5
4
42° 16.4'N
70° 33.5'W
END
● SEDIMENT SAMPLE
— OTTER TRAWL

FIGURE 27. SEDIMENT SAMPLES AND OTTER TRAWL, AREA 5
EPA CRUISE – SEPTEMBER 1982

TABLE 23
AREA 5 LOCATION DATA

Sediment Sampling

Assigned Sampling Station No.	Sample No.[1]	Latitude (N)	Longitude (W)
4	504147	42°16'16"	70°33'32"
5	505148	42°16'23"	70°32'47"

Biota Sampling (Otter Trawl)

Assigned Sampling Station No.	Sample No.[1]	Latitude (N)	Longitude (W)
1	504149	42°16'25"	70°33'40" (Start)
		42°16'09"	70°34'44" (End)

Note to Table:

(1) Radionuclide analyses for these sample numbers are in Appendix D.

6.4 ANALYTICAL PROCEDURES AND RESULTS

6.4.1 In-situ Radiation Measurements

Each deployment of the underwater gamma radiation detector lasted approximately 50 minutes. The multichannel analyzer on board ANTELOPE recorded and displayed the data. The presence of specific radionuclides and their activity levels were determined by observing the energy and amplitude of gamma radiation peaks appearing within a spectral curve. Ambient radiation, which had been measured in the reference area for this survey and was stored in the multichannel analyzer, was compared to the data obtained during measurements in the designated LLW disposal areas. No levels of radiation above ambient values (those levels of environmental radiation that occur naturally in the marine environment) were observed at any of the nine measurement locations in disposal areas.

6.4.2 Onboard Radioactivity Analyses of Sediment and Biota

Each of the randomly selected samples was counted for radiation for a minimum of 50 minutes. Ambient data were recorded every 4 hours, stored in the analyzer, and subtracted from each sample analysis. A total of 101 analyses was accomplished during the survey. The presence of elevated levels (above ambient ranges) of Cesium-137, which would indicate possible leakage of LLW from containers, was not detected in any of the analyses. All measurements for radioactivity demonstrated less than the minimum detectable level (MDL) of 0.40 picocuries of cesium per gram wet weight of sample. Naturally occurring potassium-40 was detected in all samples analyzed, as expected. Sediment samples were found to contain 1 to 2 percent potassium by weight; biota samples contained 0.5 to 1.0 percent by weight.

6.4.3 Post-Survey Radionuclide Analyses

All sediment, biota, and water samples collected were stored frozen during the survey. Upon survey conclusion, samples were packed in containers with dry ice and transported to EERF for analysis. Sediment and biota samples were subsequently prepared for analysis according to standard operating procedures of the EERF quality assurance plan.[8] Water samples remain in storage at EERF.

Specific methods for radionuclide analyses, employed by EERF, are listed below in sequential order. *NOTE: MDL is defined as the minimum value that may be detected and is estimated to be less than a 5 percent chance for errors of the first kind (deciding that a substance is present when it is not) and of the second kind (failing to decide that a substance is present when it is).*

The MDL estimates the minimum true activity that will yield a large enough signal to enable analysts to confidently state that something other than ambient variations were detected. At EERF, the MDL is typically and predominately due to the instrumental counting error and is set equal to the 2-sigma counting error for specific analyses. The MDL is in no way used to adjust measurement values.

__NOTE__: Table 24 lists the MDL's for all radionuclides identified in samples collected during the 1982 EPA Radiological Survey in Massachusetts Bay.

1. Samples were first analyzed by gamma spectroscopy, using Nuclear Data multichannel analyzers connected to either Lithium-drifted germanium or high-purity germanium crystal detectors. Samples were analyzed on a wet-weight basis, as the sample was received.

2. Samples were then dried at 110°C for 48 hours and homogenized. Determinations for gross alpha and gross beta radiation were then performed.

3. Radiochemical Analyses for Lead and Polonium.

   Polonium-209 and bismuth-207 tracers and lanthanum carriers were added to a weighed aliquot of the dried sample. The solid sample was solubilized by wet-ashing with HF, $HClO_4$, HCl, and HNO_3. The radioelements were coprecipitated as hydroxide, using NH_4OH. The hydroxide was redissolved in acid, and the bismuth and polonium were spontaneously deposited on a clean copper disk. The disk was then beta-counted for bismuth-210, using 2-inch, low-background, guarded Geiger gas-flow detectors with 500 mg/cm^2 windows. High resolution, Ge(Li), gamma spectroscopy was used to determine bismuth-207 for chemical yield. The amount of lead-210 was determined by measuring the ingrowth of its decay daughter, bismuth-210. Polonium-209 and polonium-210 were radioassayed by using alpha spectroscopy.

4. Samples were then ashed at 550°C for 72 hours to remove organics.

5. Radiochemical Analyses for Plutonium, Uranium, and Thorium.

   Plutonium-242, thorium-234, and uranium-232 tracers, and lanthanum carriers were added to a weighed aliquot of the ashed sample. The solid sample was solubilized by wet ashing. Plutonium and uranium were extracted from an HCl solution of the sample into a triisooctylamine (TIOA) solution in p-xylene.

TABLE 24
RADIONUCLIDES IDENTIFIED IN SAMPLES FROM THE EPA MASSACHUSETTS BAY RADIOLOGICAL MONITORING SURVEY

Radionuclide	Half-Life	Man-Made	Natural	Detection	MDL Biota pCi/g wet	MDL Sediment pCi/g dry
Gamma*	-	X	X	§	-	-
Gross Alpha	-	X	X	#	2.0×10^{-1}	2.0×10^{-1}
Gross Beta	-	X	X	B	1.0×10^{-1}	1.0×10^{-1}
Be-7	53.6 d	X		§	2.5×10^{-2}	2.5×10^{-2}
Mn-54	303 d	X		§	2.5×10^{-2}	2.5×10^{-2}
Co-60	5.263 y	X		§	2.5×10^{-2}	2.5×10^{-2}
Sr-90	27.7 y	X		B	2.0×10^{-2}	2.0×10^{-1}
Cs-134	2.046 y	X		§	2.5×10^{-2}	2.5×10^{-2}
Cs-137	30 y	X		§	2.5×10^{-2}	2.5×10^{-2}
Pu-238	86.4 y	X		#	1.5×10^{-3}	1.5×10^{-2}
Pu-239	24,390 y	X		#	1.5×10^{-3}	1.5×10^{-2}
K-40	1.26×10^{9}y		X	§	2.5×10^{-2}	2.5×10^{-2}
Pb-210	20.4 y		X	B	2.0×10^{-1}	2.0×10^{0}
Po-210	138.4 d		X	#	1.0×10^{-1}	1.0×10^{0}
Pb-214	26.8 m		X	§	2.5×10^{-2}	2.5×10^{-2}
Bi-214	19.7 m		X	§	2.5×10^{-2}	2.5×10^{-2}
Ra-226	1602 y		X	#	1.0×10^{-2}	1.0×10^{-1}
Th-227	18.2 d		X	#	1.5×10^{-3}	1.5×10^{-2}
Th-228	1.91 y		X	#	1.5×10^{-3}	1.5×10^{-2}
Th-230	8.0×10^{4}y		X	#	1.5×10^{-3}	1.5×10^{-2}
Th-232	1.41×10^{10}y		X	§	2.5×10^{-2}	2.5×10^{-2}
Th-232	1.41×10^{10}y		X	#	1.5×10^{-3}	1.5×10^{-2}
U-234	2.47×10^{5}y		X	#	1.5×10^{-3}	1.5×10^{-2}
U-235	7.1×10^{8}y		X	#	1.5×10^{-3}	1.5×10^{-2}
U-238	4.51×10^{9}y		X	#	1.5×10^{-3}	1.5×10^{-2}

*The mathematical program used for gamma peaks analysis can identify greater than 500 radionuclides. Only those identified are included in this table.

§ = gamma
# = alpha
B = beta
d = day
y = year
m = minute

After washing the TIOA with dilute HCl, the plutonium and uranium were stripped from the TIOA by using dilute HNO_3. The stripped solution was then wet-ashed, and the plutonium and uranium were selectively coprecipitated with 0.1 mg lanthanum as fluoride. The thorium was purified by adsorption on anion exchange resin from nitric acid, then stripped from the resin with HCl and coprecipitated. The precipitates were then filtered and radioassayed by alpha spectroscopy, using multichannel analyzers connected to surface-barrier detectors that were housed in vacuum chambers at less than 5 mm Hg.

6. Radiochemical Analyses for Strontium.

Barium, calcium, and strontium carriers were added to a weighed aliquot of the ashed sample. Magnesium was precipitated and removed from the sample at pH 3.8. Barium and strontium were adsorbed on a cation exchange resin, allowing calcium to pass through. The barium and strontium were selectively eluted, and the strontium was precipitated. Strontium-90 was radioassayed separately by measuring the ingrowth of yttrium-90. Strontium and yttrium were analyzed using 2-inch, low-background, guarded Geiger gas-flow detectors.

7. Radiochemical Analysis for Radium-226.

Solid aliquots of the ashed samples were solubilized by fusion with a special flux. The radium-226 in solution was separated by coprecipitation from the sample with barium sulfate. The precipitate was solubilized and sealed in a deemanation tube for 28 days. During that time, radon-222 ingrowth proceeded. The tubes were then connected to a gas manifold, and the accumulated radon-222 was flushed into evacuated Lucas alpha-scintillation counting cells. The alpha-scintillation cells were then placed directly on 2-inch photomultiplier tubes, and events were registered on counting scalers.

EERF analytical results for radionuclides in each sediment and biota sample are given in Appendix D. Tables 25 through 28 present a summary of the data included in Appendix D. Summaries for biota appear in Table 25 for man-made radionuclides and in Table 26 for naturally occurring radionuclides. For sediment, the summary in Table 27 pertains to man-made radionuclides, while Table 28 summarizes data results for natural radionuclides. In each Table, mean activity is given by radionuclide and survey area, along with the standard deviation for that analysis. The total number of analyses performed is also shown, along with the number of those analyses yielding measurements below or equal to MDL. Also shown are the percentage of total analyses that were above MDL. Comparisons to MDL are presented to provide a perspective on the levels of radioactivity observed in samples collected. Data for both natural and man-made radionuclides are presented, since all substances in the natural environment contain some levels of radioactivity. Information on the amount of natural radionuclides is useful in estimating the normal amounts of natural radioactivity in humans that might be due to seafood consumption.

With the exception of activity levels for natural radionuclides in sediment, most EERF analyses for radionuclides in biota and sediment samples collected from Massachusetts Bay show levels of radioactivity below the MDL. Values for cesium-137, plutonium-238, and plutonium-239 that are above the MDL in sediment samples are likely attributable to normal fallout distribution. However, for those analyses showing results above the MDL, including both man-made and natural radionuclides, the values are within expected ambient ranges reported previously for marine sediment and biota samples.[9] The final EERF analyses results are also consistent with preliminary data that EPA presented earlier.[10]

TABLE 25
SUMMARY, EERF ANALYSES OF BIOTA(1) SAMPLES (MAN-MADE RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(2) ρ Ci/g (Wet)	Standard Deviation	Total No. Analyses Performed	No. of Analyses ≤ MDL	Percent of Analyses >MDL
Gamma Scan Analyses(3)						
1	Co-60	1.0×10^{-2}	---	55	55	0
2		9.0×10^{-3}	7.0×10^{-3}	13	13	0
3		---	---	11	11	0
4		2.0×10^{-2}	---	32	32	0
5		---	---	1	1	0
1	Cs-137	3.5×10^{-2}	3.0×10^{-2}	55	51	7
2		5.0×10^{-3}	---	13	13	0
3		---	---	11	11	0
4		1.6×10^{-2}	---	32	32	0
5		---	---	1	1	0
Gross Analyses(4)(5)						
1	Alpha	-4.3×10^{-2}	1.2×10^{-1}	53	52	2
2		-3.4×10^{-2}	7.2×10^{-2}	13	13	0
3		-6.4×10^{-2}	2.3×10^{-1}	11	10	9
4		-2.3×10^{-1}	3.8×10^{-1}	32	31	3
5		1.0×10^{-1}	---	1	1	0
1	Beta	3.8×10^{0}	6.8×10^{-1}	53	0	100
2		3.3×10^{0}	9.4×10^{-1}	13	0	100
3		4.3×10^{0}	3.6×10^{0}	11	0	100
4		8.6×10^{0}	7.1×10^{0}	32	0	100
5		2.7×10^{0}	---	1	0	100

(Continued)

TABLE 25 (Continued)
SUMMARY, EERF ANALYSES OF BIOTA(1) SAMPLES (MAN-MADE RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(2) p Ci/g (Wet)	Standard Deviation	Total No. Analyses Performed	No. of Analyses ≤ MDL	Percent of Analyses >MDL
Specific Alpha Analysis						
1	Pu-238	2.8×10^{-4}	4.8×10^{-4}	36	35	3
2		1.8×10^{-1}	3.1×10^{-1}	4	2	50
3		2.2×10^{-4}	6.4×10^{-5}	3	3	0
4		6.6×10^{-4}	6.3×10^{-4}	21	18	14
5		—	—	0	—	—
1	Pu-239	5.7×10^{-5}	2.0×10^{-4}	36	36	0
2		1.7×10^{-3}	1.7×10^{-3}	4	2	50
3		2.9×10^{-4}	3.2×10^{-4}	3	3	0
4		2.3×10^{-4}	3.8×10^{-4}	21	20	5
5		—	—	0	—	—
Specific Beta Analysis						
1	Sr-90	-8.6×10^{-4}	3.4×10^{-3}	32	32	0
2		1.4×10^{-3}	1.6×10^{-3}	4	4	0
3		-2.6×10^{-4}	2.4×10^{-4}	2	2	0
4		-2.2×10^{-3}	3.5×10^{-3}	16	16	0
5		—	—	0	—	—

Notes to Table:

(1) Includes edible and non-edible samples.

(2) See page 95 for meaning of negative numbers.

(3) Gamma analyses were performed using two volumes (85 ml and 400 ml) and standard geometries. All gamma peaks that were of discernible levels were analyzed using a computer program (MONSTR) developed at Oak Ridge National Laboratories. Only those radionuclides identified are listed.

(4) Includes data for man-made and natural radionuclides.

(5) Used to decide whether to perform specific analyses.

TABLE 26
SUMMARY, EERF ANALYSES OF BIOTA(1) SAMPLES (NATURAL RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(2) ρ ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses $\leqq$ MDL	Percent of Analyses >MDL
Gamma Scan Analyses(3)						
1	Bi-214	9.9x10^{-2}	4.5x10^{-2}	55	50	9
2		---	---	13	13	0
3		---	---	11	11	0
4		---	---	32	32	0
5		4.2x10^{-2}	---	1	0	100
1	K-40	3.0x10^{0}	6.6x10^{-1}	55	0	100
2		3.2x10^{0}	8.8x10^{-1}	13	0	100
3		2.7x10^{0}	9.9x10^{-1}	11	0	100
4		2.6x10^{0}	9.3x10^{-1}	32	0	100
5		3.2x10^{0}	---	1	0	100
1	Pb-214	9.0x10^{-2}	4.1x10^{-2}	55	51	7
2		---	---	13	13	0
3		---	---	11	11	0
4		---	---	32	32	0
5		3.7x10^{-2}	---	1	0	100
1	Th-232	8.4x10^{-2}	4.0x10^{-3}	55	53	4
2		---	---	13	13	0
3		---	---	11	11	0
4		---	---	32	32	0
5		---	---	1	1	0
Specific Alpha Analyses						
1	Po-210	7.5x10^{-2}	1.0x10^{-1}	44	33	25
2		1.5x10^{-1}	1.7x10^{-1}	8	6	25
3		3.3x10^{-2}	5.6x10^{-2}	7	6	14
4		7.5x10^{-2}	7.9x10^{-2}	30	21	30
5		3.7x10^{-2}	---	1	1	0
1	Ra-226	1.1x10^{-2}	1.1x10^{-2}	40	30	25
2		8.2x10^{-3}	7.0x10^{-3}	8	6	25
3		4.1x10^{-3}	2.8x10^{-3}	7	7	0
4		8.8x10^{-3}	9.4x10^{-3}	27	23	15
5		1.0x10^{-2}	---	1	1	0

(Continued)

TABLE 26 (Continued)
SUMMARY, EERF ANALYSES OF BIOTA(1) SAMPLES (NATURAL RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(2) ρ ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses $\leqq$ MDL	Percent of Analyses >MDL
1	Th-227	9.3×10^{-4}	1.6×10^{-3}	36	28	22
2		7.6×10^{-4}	1.4×10^{-3}	8	5	38
3		5.7×10^{-4}	6.6×10^{-4}	6	5	17
4		4.1×10^{-3}	1.3×10^{-2}	19	13	32
5		---	---	0	--	--
1	Th-228	2.7×10^{-3}	1.3×10^{-2}	36	18	50
2		4.9×10^{-3}	6.4×10^{-3}	8	4	50
3		2.6×10^{-3}	3.4×10^{-3}	6	4	33
4		2.4×10^{-2}	8.5×10^{-2}	19	9	53
5		---	---	0	--	--
1	Th-230	5.7×10^{-3}	8.5×10^{-3}	36	14	61
2		5.2×10^{-3}	6.5×10^{-3}	8	4	50
3		1.8×10^{-3}	1.4×10^{-3}	6	3	50
4		2.1×10^{-2}	7.5×10^{-2}	19	8	58
5		---	---	0	--	--
1	Th-232	4.4×10^{-3}	6.9×10^{-3}	36	20	44
2		3.9×10^{-3}	4.2×10^{-3}	8	4	50
3		1.7×10^{-3}	1.5×10^{-3}	6	3	50
4		2.3×10^{-2}	8.1×10^{-2}	19	9	53
5		---	---	0	--	--
1	U-234	2.1×10^{-2}	5.6×10^{-2}	26	3	88
2		1.1×10^{-2}	8.2×10^{-4}	3	0	100
3		4.3×10^{-3}	4.8×10^{-3}	3	2	33
4		9.8×10^{-3}	9.1×10^{-3}	22	1	95
5		---	---	0	--	--
1	U-235	1.1×10^{-3}	3.0×10^{-3}	26	24	8
2		4.6×10^{-4}	1.9×10^{-4}	3	3	0
3		3.3×10^{-4}	3.4×10^{-4}	3	3	0
4		6.9×10^{-4}	9.0×10^{-4}	22	18	18
5		---	---	0	--	--

(Continued)

TABLE 26 (Continued)
SUMMARY, EERF ANALYSES OF BIOTA(1) SAMPLES (NATURAL RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(2) p ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses ≦ MDL	Percent of Analyses >MDL
1	U-238	1.5×10^{-2}	3.8×10^{-2}	26	6	77
2		7.9×10^{-3}	6.6×10^{-4}	3	0	100
3		3.1×10^{-3}	3.2×10^{-3}	3	2	33
4		8.5×10^{-3}	7.4×10^{-3}	22	2	91
5		—	—	0	—	—
Specific Beta Analysis						
1	Pb-210	2.4×10^{-2}	1.2×10^{-1}	44	41	7
2		-7.6×10^{-2}	1.4×10^{-1}	8	8	0
3		1.2×10^{-1}	1.3×10^{-1}	7	4	43
4		1.5×10^{-2}	1.2×10^{-1}	29	28	3
5		-2.9×10^{-3}	—	1	1	0

Notes to Table:

(1) Includes edible and non-edible samples.

(2) See page 95 for meaning of negative numbers.

(3) Gamma analyses were performed using two volumes (85 ml and 400 ml) and standard geometries. All gamma peaks that were of discernible levels were analyzed using a computer program (MONSTR) developed at Oak Ridge National Laboratories. Only those radionuclides identified are listed.

TABLE 27
SUMMARY, EERF ANALYSES OF SEDIMENT SAMPLES (MAN-MADE RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(1) ρ ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses $\leq$ MDL	Percent of Analyses >MDL
Gamma Scan Analyses(2)						
1	Co-60	—	—	47	47	0
2		—	—	23	23	0
3		—	—	15	15	0
4		1.9×10^{-2}	—	28	28	0
5		—	—	2	2	0
1	Cs-134	—	—	47	47	0
2		5.0×10^{-2}	—	23	22	4
3		—	—	15	15	0
4		—	—	28	28	0
5		—	—	2	2	0
1	Cs-137	1.2×10^{-1}	3.4×10^{-2}	47	4	91
2		6.1×10^{-2}	2.7×10^{-2}	23	4	83
3		1.1×10^{-1}	1.1×10^{-1}	15	1	93
4		9.1×10^{-2}	2.2×10^{-2}	28	0	100
5		3.1×10^{-2}	—	2	1	50
1	Mn-54	1.7×10^{-2}	—	47	47	0
2		8.6×10^{-3}	—	23	23	0
3		1.5×10^{-2}	—	15	15	0
4		—	—	28	28	0
5		—	—	2	2	0
Gross Analyses(3)(4)						
1	Alpha	8.4×10^{0}	3.6×10^{0}	48	0	100
2		6.9×10^{0}	3.3×10^{0}	23	0	100
3		5.8×10^{0}	2.9×10^{0}	15	0	100
4		5.2×10^{0}	3.5×10^{0}	28	0	100
5		6.0×10^{0}	1.2×10^{0}	2	0	100
1	Beta	$3.9\times10^{+1}$	7.6×10^{0}	48	0	100
2		$3.6\times10^{+1}$	5.2×10^{0}	23	0	100
3		$3.8\times10^{+1}$	6.7×10^{0}	15	0	100
4		$4.0\times10^{+1}$	4.8×10^{0}	28	0	100
5		$3.0\times10^{+1}$	2.8×10^{0}	2	0	100

(Continued)

TABLE 27 (Continued)
SUMMARY, EERF ANALYSES OF SEDIMENT SAMPLES (MAN-MADE RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity(1) p ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses ≤ MDL	Percent of Analyses >MDL
Specific Alpha Analyses						
1		1.3x10^{-2}	7.1x10^{-3}	28	17	39
2		1.2x10^{-2}	1.1x10^{-2}	7	5	29
3	Pu-238	1.0x10^{-2}	1.1x10^{-2}	6	5	17
4		1.8x10^{-2}	3.8x10^{-2}	28	19	32
5		1.7x10^{-2}	—	1	0	100
1		3.6x10^{-2}	2.5x10^{-2}	28	7	75
2		2.5x10^{-2}	1.1x10^{-2}	7	1	86
3	Pu-239	3.2x10^{-2}	1.0x10^{-2}	6	0	100
4		3.9x10^{-2}	2.0x10^{-2}	28	3	89
5		8.4x10^{-3}	—	1	1	0
Specific Beta Analysis						
1		5.5x10^{-2}	4.0x10^{-2}	25	25	0
2		5.4x10^{-2}	1.1x10^{-2}	2	2	0
3	Sr-90	7.2x10^{-2}	5.0x10^{-2}	3	3	0
4		-2.5x10^{-2}	6.5x10^{-2}	21	21	0
5		0.0x10^{-1}	—	1	1	0

Notes to Table:

(1) See page 95 for meaning of negative numbers.

(2) Gamma analyses were performed using two volumes (85 ml and 400 ml) and standard geometries. All gamma peaks that were of discernible levels were analyzed using a computer program (MONSTR) developed at Oak Ridge National Laboratories. Only those radionuclides identified are listed.

(3) Includes data for man-made and natural radionuclides.

(4) Used to decide whether to perform specific analyses.

TABLE 28
SUMMARY, EERF ANALYSES OF SEDIMENT SAMPLES (NATURAL RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity ρ ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses $\leq$ MDL	Percent of Analyses >MDL
Gamma Scan Analyses(1)						
1	Be-7	1.0×10^{-1}	--	47	46	2
2		--	--	23	23	0
3		--	--	15	15	0
4		4.4×10^{-1}	--	28	27	4
5		--	--	2	2	0
1	Bi-214	7.8×10^{-1}	1.7×10^{-1}	47	0	100
2		8.2×10^{-1}	1.7×10^{-1}	23	0	100
3		7.4×10^{-1}	1.4×10^{-1}	15	0	100
4		7.5×10^{-1}	8.2×10^{-2}	28	0	100
5		6.2×10^{-1}	3.8×10^{-2}	2	0	100
1	K-40	$2.0\times10^{+1}$	2.3×10^{0}	47	0	100
2		$2.0\times10^{+1}$	6.2×10^{0}	23	0	100
3		$2.1\times10^{+1}$	4.8×10^{0}	15	0	100
4		$2.0\times10^{+1}$	3.9×10^{0}	28	0	100
5		$1.6\times10^{+1}$	--	2	0	100
1	Pb-214	8.3×10^{-1}	1.6×10^{-1}	47	0	100
2		8.7×10^{-1}	1.8×10^{-1}	23	0	100
3		7.8×10^{-1}	1.4×10^{-1}	15	0	100
4		7.9×10^{-1}	1.5×10^{-1}	28	0	100
5		6.4×10^{-1}	3.1×10^{-2}	2	0	100
1	Th-232	8.4×10^{-1}	1.1×10^{-1}	47	0	100
2		8.8×10^{-1}	2.1×10^{-1}	23	0	100
3		8.6×10^{-1}	1.9×10^{-1}	15	0	100
4		8.8×10^{-1}	7.0×10^{-2}	28	0	100
5		6.8×10^{-1}	6.2×10^{-3}	2	0	100

(Continued)

TABLE 28 (Continued)
SUMMARY, EERF ANALYSES OF SEDIMENT SAMPLES (NATURAL RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity ρ ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses ≤ MDL	Percent of Analyses >MDL
Specific Alpha Analyses						
1	Po-210	2.4×10^{0}	5.4×10^{-1}	8	0	100
2		1.9×10^{0}	1.0×10^{-1}	2	0	100
3		1.9×10^{0}	3.1×10^{-1}	3	0	100
4		2.6×10^{0}	3.8×10^{-1}	15	0	100
5		1.1×10^{0}	--	1	0	100
1	Ra-226	1.0×10^{0}	2.9×10^{-1}	27	0	100
2		9.2×10^{-1}	1.5×10^{-1}	7	0	100
3		9.9×10^{-1}	1.2×10^{-1}	6	0	100
4		9.7×10^{-1}	1.3×10^{-1}	28	0	100
5		7.4×10^{-1}	--	1	0	100
1	Th-227	2.4×10^{-1}	1.3×10^{-1}	23	0	100
2		1.8×10^{-1}	3.1×10^{-2}	6	0	100
3		2.1×10^{-1}	6.6×10^{-2}	6	0	100
4		1.6×10^{-1}	7.3×10^{-2}	26	0	100
5		9.0×10^{-2}	--	1	0	100
1	Th-228	1.0×10^{0}	2.2×10^{-1}	23	0	100
2		8.8×10^{-1}	1.2×10^{-1}	6	0	100
3		1.0×10^{0}	1.5×10^{-1}	6	0	100
4		1.0×10^{0}	1.0×10^{-1}	26	0	100
5		7.6×10^{-1}	--	1	0	100
1	Th-230	1.1×10^{0}	2.1×10^{-1}	23	0	100
2		8.3×10^{-1}	1.4×10^{-1}	6	0	100
3		1.1×10^{0}	2.0×10^{-1}	6	0	100
4		1.2×10^{0}	2.4×10^{-1}	26	0	100
5		7.2×10^{-1}	--	1	0	100
1	Th-232	1.2×10^{0}	2.2×10^{-1}	23	0	100
2		1.0×10^{0}	1.4×10^{-1}	6	0	100
3		1.2×10^{0}	2.0×10^{-1}	6	0	100
4		1.3×10^{0}	2.8×10^{-1}	26	0	100
5		9.0×10^{-1}	--	1	0	100

(Continued)

TABLE 28 (Continued)
SUMMARY, EERF ANALYSES OF SEDIMENT SAMPLES (NATURAL RADIONUCLIDES)
EPA RADIOLOGICAL MONITORING SURVEY
MASSACHUSETTS BAY, 1982

Survey Area	Nuclide	Mean Activity ρ ci/g (Wet)	Standard Deviation	Total Number of Analyses Performed	Number of Analyses ≤ MDL	Percent of Analyses >MDL
1	U-234	1.2×10^{0}	3.9×10^{-1}	25	0	100
2		7.6×10^{-1}	3.1×10^{-1}	7	0	100
3		1.1×10^{0}	2.2×10^{-1}	5	0	100
4		1.0×10^{0}	1.7×10^{-1}	25	0	100
5		4.9×10^{-1}	—	1	0	100
1	U-235	5.7×10^{-2}	3.2×10^{-2}	25	1	96
2		5.4×10^{-2}	3.3×10^{-2}	7	0	100
3		5.0×10^{-2}	1.6×10^{-2}	5	0	100
4		4.3×10^{-2}	2.1×10^{-2}	25	0	100
5		2.6×10^{-2}	—	1	0	100
1	U-238	1.0×10^{0}	2.5×10^{-1}	25	0	100
2		7.6×10^{-1}	2.1×10^{-1}	7	0	100
3		9.2×10^{-1}	2.0×10^{-1}	5	0	100
4		9.9×10^{-1}	1.2×10^{-1}	25	0	100
5		7.1×10^{-1}	—	1	0	100
Specific Beta Analysis						
1	Pb-210	3.5×10^{0}	1.4×10^{0}	8	1	88
2		1.0×10^{0}	8.5×10^{-1}	2	2	0
3		1.6×10^{0}	5.2×10^{-1}	3	2	33
4		3.0×10^{0}	1.0×10^{0}	15	2	87
5		1.2×10^{0}	—	1	1	0

Note to Table:

(1) Gamma analyses were performed using two volumes (85 ml and 400 ml) and standard geometries. All gamma peaks that were of discernible levels were analyzed using a computer program (MONSTR) developed at Oak Ridge National Laboratories. Only those radionuclides identified are listed.

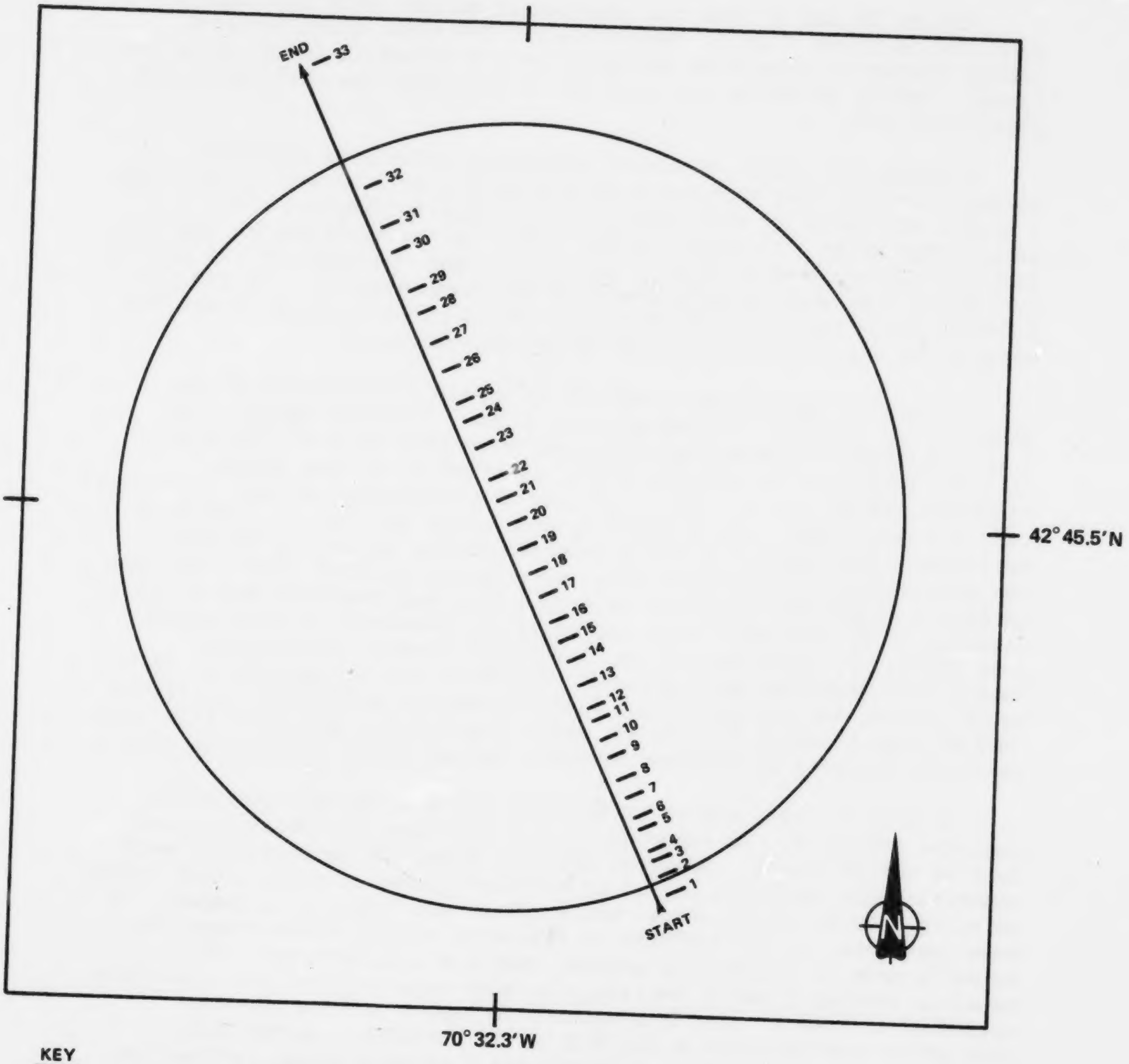
6.4.4 Analysis of Underwater Television Video Tapes

Figures 28 and 29 show the location of survey lines that were completed in Areas 4 and 1, respectively. The video tapes recorded during underwater television surveying were examined in detail after the survey. Tables 29 and 30 are provided to show what was observed during video recording.

Although the amount of actual underwater television surveying accomplished was less than had been planned for this survey, it provided a useful assessment of environmental conditions in disposal and nondisposal areas. It also provided for a limited confirmation that LLW disposal had occurred in Area 1, based upon what was observed and what we previously knew about packaging of LLW for ocean disposal. It did not, however, allow for positive identification of those concrete clumps and metal drums that were observed as being LLW containers.

A distinct contrast was observed in biotic environments of the disposal and baseline reference survey areas. Numerous benthic and freely swimming organisms were observed throughout most of the video obtained from Area 4. Brittle stars, starfish of various sizes, flounders, eels, sea urchins, a variety of crustaceans, shrimp, and small rat-tail-type fishes were frequently seen along the line of television surveying. The numbers of biota observed during the survey of Area 1, the Boston Foul Site disposal area, were generally fewer than those seen in Area 4 except for a portion of Area 1 that was characterized by the presence of an extremely large amount of sea anemones, in some places even giving the appearance of an "underwater forest" of anemones. Sponge-like organisms were attached to some of the bottom debris. Eels, squid, motile and bottom-resting fish, flounders, starfishes (generally smaller than observed in Area 4), small crustaceans, and small fish lying partially immersed in sediment were the typical biota observed in Area 1.

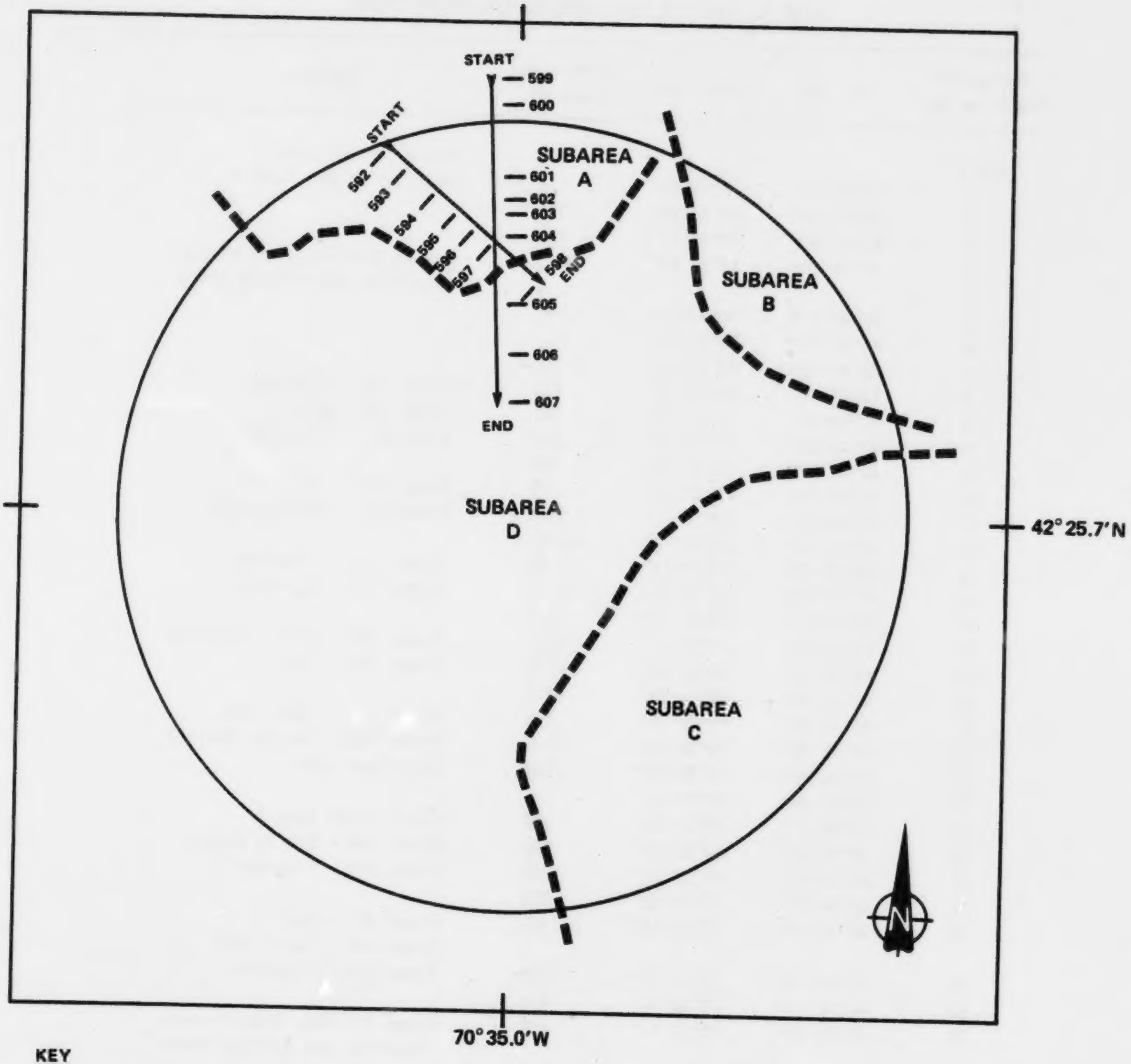
In Area 4, there was no evidence of man-made objects that would indicate disposals. As expected, Area 1 was found to contain a great deal of bottom debris. Numerous concrete clumps of various sizes were observed; some partially buried by sediment. Some of these clumps appear to be of drum or barrel shape, while others are irregularly shaped. In some instances, it is difficult to determine whether these clumps are actually made of concrete or whether they are rock outcrops. Six metallic-looking drums or barrels were also observed from the video data collected in Area 1. One drum appears to have a lifting eye-hook protruding from concrete on one end of the container, as had been observed on LLW disposal drums during EPA surveys of other radioactive waste disposal sites in the Pacific and Atlantic Oceans. In addition to concrete clumps and metal drums or barrels, a large amount of other debris was frequently seen from the video obtained in Area 1. Much of this material appeared to be twisted metal and conglomerate materials associated with debris from demolition of buildings. Objects of this type are not included in Table 30.


END
START
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
42° 45.5′N
70° 32.3′W
N

KEY

NUMBERS REFER TO SURVEY NAVIGATION POSITION NUMBERS (SEE TABLE 29)

FIGURE 28. UNDERWATER TELEVISION SURVEYING, AREA 4, EPA RADIOLOGICAL MONITORING SURVEY – 1982


START
599
600
START
SUBAREA
A
601
602
603
604
592
593
594
595
596
597
598
END
605
SUBAREA
B
606
607
END
SUBAREA
D
42°25.7'N
SUBAREA
C
N
70°35.0'W

KEY

NUMBERS REFER TO SURVEY NAVIGATION
POSITION NUMBERS (SEE TABLE 30)

FIGURE 29. UNDERWATER TELEVISION LINES, BOSTON "FOUL SITE" AREA 1, EPA SURVEY – MASSACHUSETTS BAY 1982

TABLE 29
UNDERWATER TELEVISION SURVEY LOG
AREA 4, 1982 EPA RADIOLOGICAL MONITORING SURVEY

Navigation Position No.	Lat. (N)	Long. (W)	Video Tape Frame No.	Remarks
Start			--	Begin Survey Line
1	42°44'31"	70°31'49"	178	Start of Video, Tape 1
2	42°44'34"	70°31'50"	314	
3	42°44'36"	70°31'52"	401	
4	42°44'38"	70°31'54"	473	Frames 485-529, Area of many Starfish and Brittle Stars
5	42°44'41"	70°31'57"	543	
6	42°44'43"	70°31'59"	--	
7	42°44'46"	70°32'01"	672	
8	42°44'49"	70°32'03"	733	Frame 736 - Flounder
9	42°44'52"	70°32'03"	792	Frame 795 - Eel
10	42°44'55"	70°32'04"	845	Frame 836 - Flounder
11	42°44'58"	70°32'05"	899	
12	42°45'00"	70°32'08"	950	Frame 935 - Eel
13	42°45'03"	70°32'11"	1000	Frame 963 - Sea Urchins
14	42°45'07"	70°32'14"	1049	
15	42°45'10"	70°32'17"	1101	Frame 1124 - Flounder
16	42°45'13"	70°32'19"	1151	Frame 1165 - Flounder
17	42°45'17"	70°32'21"	1194	
18	42°45'20"	70°32'21"	1237	Frame 1245, 1278 - Starfish
19	42°45'24"	70°32'22"	1315	Frame 1280 - Eel
20	42°45'28"	70°32'23"	1355	
21	42°45'32"	70°32'25"	1397	Frame 1406, 1420 - Eel
22	42°45'35"	70°32'28"	1435	Frame 1433 - Anchor Chain??
23	42°45'40"	70°32'32"	1467	End Video Tape 1
24	42°45'44"	70°32'34"	--	
25	42°45'47"	70°32'35"	139	Start Video Tape 2
26	42°45'52"	70°32'35"	238	Frame 296 - Eel in Rocks
27	42°45'56"	70°32'37"	329	Frame 339 - Flounder
28	42°46'01"	70°32'40"	403	
29	42°46'04"	70°32'41"	481	Frame 457 - Eel
				Frame 469 - Large Crab
30	42°46'10"	70°32'42"	551	Frame 530 - Flounder
31	42°46'14"	70°32'46"	618	
32	42°46'20"	70°32'47"	680	Frame 655-680, Area of many Starfish and Brittle Stars
				Frame 727 - Eel
33	42°46'39"	70°32'55"	740	End Survey Line

TABLE 30

UNDERWATER TELEVISION SURVEY LOG

AREA 1, BOSTON FOUL SITE

EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Navigation Position No.	Lat. (N)	Long. (W)	Video Tape Frame No.	Observations
592	42°26'36"	70°35'27"	179	Begin Line 1
			183	Concrete Clump
			192	Concrete Clump
			195	Concrete Clump
			198	Concrete Clump
			206	Partially Buried Concrete Clump
593	42°26'33"	70°35'24"	208	
			221	Drum-Shaped Concrete Clump
			235	Large Concrete Clump
594	42°26'29"	70°35'18"	237	
			249	Group of Concrete Clumps
			251	Group of Concrete Clumps
			258	Large, Drum-Shaped Concrete Clump
595	42°26'26"	70°35'13"	270	
			272	Concrete Clumps
			277	Large Concrete Clumps
596	42°26'23"	70°35'08"	289	Large Concrete Clump
			317	Large Concrete Clump
597	42°26'21"	70°35'06"	336	
			393	Small Concrete Clumps
598	42°26'15	70°34'55"	401	End Line 1
599	42°26'46"	70°35'06"	404	Begin Line 2
600	42°26'43"	70°35'06"	516	
			518	Metal Drum (Hole in Drum??)
			571	Small Squid Swimming
			607	Flounder on Bottom
			727	Flounder on Bottom
			846	Small Concrete Clump and Starfish
601	42°26'32"	70°35'05"	876	
			888	Metal Drum (Marking on End??)
			913	Small Crab
			945	Starfish
602	42°26'28"	70°35'05"	946	
			953	Metal Drum
603	42°26'25"	70°35'05"	974	
			983	Metal Drum with Eye-Hook

(Continued)

TABLE 30 (Continued)
UNDERWATER TELEVISION SURVEY LOG
AREA 1, BOSTON FOUL SITE
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Navigation Position No.	Lat. (N)	Long. (W)	Video Tape Frame No.	Observations
604	42°26'21"	70°35'04"	1046	
			1207	"Forest" of Sea Anemones
			1267	"Forest" of Sea Anemones
605	42°26'11"	70°35'04"	1304	
			1361	Metal Drum
606	42°26'04"	70°35'03"	1370	Small Concrete Clumps and Flounder on Bottom
			1418	Metal Drum - Partially in Sediment
			1423	Starfish
			1443	Drum-Shaped Concrete Clump
607	42°25'57"	70°35'03	1475	End Line 2

SECTION 7

DATA REPORTING RATIONALE AND PROCEDURES

The EPA Office of Radiation Program's quality assurance program is intended to provide accurate, usable environmental radiation data to the public. Thus, except for gamma spectrometry, radionuclide analyses are reported as the counting results indicate, whether the number is negative, zero, or positive.

When conducting specific radionuclide analyses, concentrations of a radionuclide in environmental samples are frequently close to zero. When the actual concentration of a nuclide is zero, the net counting results should statistically show a distribution of negative and positive numbers about zero. This occurs when the radiation instrument and detector background counts are subtracted from a sample that contains only environmental background or ambient levels of radiation. Reporting data in this format allows all the data to be presented and evaluated statistically without an arbitrary cutoff of small or negative numbers. This approach facilitates estimates of bias in the nuclide analyses and allows for better evaluation of distributions and trends in environmental data.

When reviewing the data in this report, caution should be exercised in the interpretation of individual negative values. Obviously, a negative value does not have physical significance. Such numbers, however, are significant when taken together with other observations indicating that the true value of a distribution is near zero. Reported values are presented as follows:

- Specific Analyses - reported as the counting results indicate, either negative, zero, or positive (except for gamma spectrum analyses). Numerical values are back calculated to account for radioactive decay to the collection date.
- Gross Analyses - the actual value of gross radioactivity is reported, unless the value is below the minimum detectable level (MDL) at the 2-sigma confidence level; then the MDL is reported.
- Error Terms - each specific analysis result is accompanied by a counting error term at the 2-sigma (95 percent) confidence interval. Thus, error terms are reported as counting errors.
- Averages - calculated in summaries. In calculating averages, all values of individual data are utilized, including negative numbers.

SECTION 8

DISCUSSION AND CONCLUSIONS

This report presents data from four separate studies conducted in Massachusetts Bay in 1981 and 1982. Each study accomplished a specific purpose. The NOAA side scan sonar survey identified locations of bottom objects in one of the designated disposal areas. Some of these objects may be LLW containers. The EPA/FDA marketplace sampling and analysis program identified levels of radioactivity in marketed seafoods collected from the Bay. The sediments and biota collected by NOAA and SAI, and during the EPA radiological monitoring survey, provided an assessment of the radiological environment within designated disposal areas and in surrounding areas of the Bay.

All sediment and biota samples were analyzed by EPA's Eastern Environmental Radiation Facility to determine activity levels for both man-made and natural radionuclides. The number of samples obtained provides an intensive and broad-based spectrum of data from the Massachusetts Bay region.

EPA has carefully studied the radioanalysis results of samples acquired from each of these studies. Measurements were found to be within or below previously reported ranges of environmental background or ambient radiation levels.[9][17][18] Most of the measurements for man-made radionuclides resulted in values below minimum detection levels. Some analyses are shown as negative numbers because of radiation counting statistics for extremely low or essentially zero activity levels. When sample activity levels are near or at background levels and background activity is subtracted, negative numbers result.

EPA Radiological Monitoring Survey

Upon completion of the radionuclide analyses procedures for biota and sediment samples, the data from each survey area was examined to determine the extent of statistical analysis to be performed. EERF personnel then statistically compared values of radioactivity for edible and nonedible biota and sediment samples collected from Area 1 and Area 4, using the Student-t test for difference between mean values. These areas were chosen for statistical comparison because they essentially represent nondisposal (Area 4) and disposal (Area 1) locations. The analysis compared all nuclides identified by analyses of Area 1 samples to all nuclides identified in Area 4. The overall results of this statistical analysis were not found to be significantly (95 percent confidence level) different.

Table 31 compares individual mean values of radionuclide analyses for edible biota samples from survey areas 1 and 4. Only for gross beta analysis (essentially a screening procedure) was there a significant difference in activity levels. Table 32 compares mean values for nonedible biota analyses from the same areas. Significant differences in activity levels were only found for naturally occurring potassium-40 and gross beta analyses. In each of these instances, however, the values were higher in the control area than in the disposal area. Table 33 refers to sediment analyses. Significant differences in activity levels were only observed for strontium-90, and gross alpha analyses (essentially a screening procedure). These values were also higher in the baseline reference area of the survey than in the disposal area.

More specific statistical tests were subsequently completed by EPA/ORP statisticians to evaluate the data for man-made radionuclides, as follows:

Area 1 Sediment Samples

A one-way analysis of variance compared data from Area 1 (disposal area) to Area 4 (reference area). Area 1 data were grouped separately by subareas A, B, C and D (figure 10). In the analysis, each subarea was evaluated independently and comparisons were made for Cs-137, Pu-238, Pu-239 and Sr-90. No statistically significant results were found for Pu-238, Pu-239 or Sr-90. There were, however, statistically significant differences between Area 1 and Area 4 for Cs-137.

Duncan's multiple range test was then used for Cs-137 data to determine which subarea or subareas of Area 1 might be significantly different from each other and from Area 4. Significant differences were found in two of the subareas. Cs-137 was significantly lower than Area 4 in subarea B, but significantly higher than Area 4 in subarea C. No significant differences were found for the levels of Cs-137 in subareas A and D or Area 4. The overall significance of Duncan's multiple range test should be regarded carefully because of variations in the number of samples with measureable levels of cesium-137 from each subarea of Area 1. The results for subarea B, which tested significantly low, and for subarea C, which tested significantly high, are based on two and four analysis results respectively. In contrast, the results for subareas A and D and Area 4 are based on a larger number of observations - 23, 11 and 26 analysis results respectively.

One additional test was performed, using the Cs-137 and Pu-239 analysis data from Areas 1 and 4. Individual data points for each of these nuclides from Area 1 were compared to their mean values in Area 4. This was done to determine how many of the individual nuclide concentrations in Area 1 were significantly higher (at the 5% significance level) than the mean level in Area 4. It was expected that, if there

TABLE 31
COMPARISON OF RADIONUCLIDE ANALYSES FOR EDIBLE BIOTA, AREAS 1 AND 4
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Radionuclides	Area 1		Area 4	
	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.
Man-Made				
Co-60	1.0×10^{-2}	-	2.0×10^{-2}	-
Sr-90	-3.3×10^{-4}	2.9×10^{-3}	-1.4×10^{-3}	2.9×10^{-3}
Cs-137	3.5×10^{-2}	9.7×10^{-2}	1.6×10^{-2}	-
Pu-238	3.3×10^{-4}	5.1×10^{-4}	6.6×10^{-4}	6.0×10^{-4}
Pu-239	6.3×10^{-5}	2.2×10^{-4}	2.7×10^{-4}	4.1×10^{-4}
Natural				
K-40	3.1×10^{0}	5.4×10^{-1}	2.9×10^{0}	6.3×10^{-1}
Po-210	8.4×10^{-2}	1.1×10^{-1}	8.5×10^{-2}	8.0×10^{-2}
Pb-210	2.5×10^{-2}	1.2×10^{-1}	1.9×10^{-2}	1.3×10^{-1}
Pb-214	9.6×10^{-2}	4.2×10^{-2}	NDA	-
Bi-214	1.0×10^{-1}	4.7×10^{-2}	NDA	-
Ra-226	1.1×10^{-2}	1.1×10^{-2}	9.7×10^{-3}	9.9×10^{-3}
Th-227	1.0×10^{-3}	1.7×10^{-3}	4.8×10^{-3}	1.4×10^{-2}
Th-228	2.8×10^{-3}	1.4×10^{-2}	2.9×10^{-2}	9.2×10^{-2}
Th-230	6.4×10^{-3}	9.1×10^{-3}	2.5×10^{-2}	8.1×10^{-2}
Th-232(1)	8.8×10^{-2}	-	NDA	-
Th-232(2)	4.9×10^{-3}	7.4×10^{-3}	2.7×10^{-2}	8.8×10^{-2}
U-234	2.7×10^{-2}	6.4×10^{-2}	6.1×10^{-3}	5.8×10^{-3}
U-235	1.2×10^{-3}	3.5×10^{-3}	4.3×10^{-4}	8.1×10^{-4}
U-238	2.0×10^{-2}	4.3×10^{-2}	6.4×10^{-3}	6.1×10^{-3}
Gross Alpha Analysis	-3.0×10^{-2}	1.2×10^{-1}	-2.2×10^{-1}	3.9×10^{-1}
Gross Beta Analysis	4.1×10^{0}	2.0×10^{0}	8.9×10^{0}	7.2×10^{0}

Notes to Table:

(1) Gamma Scan
(2) Specific Analysis
NDA = No Detectable Activity

TABLE 32
COMPARISON OF RADIONUCLIDE ANALYSES FOR NONEDIBLE BIOTA, AREAS 1 AND 4
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Radionuclides	Area 1		Area 4	
Man-Made	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.
Co-60	NDA	-	NDA	-
Sr-90	-3.2×10^{-3}	4.2×10^{-3}	-7.5×10^{-3}	2.5×10^{-3}
Cs-137	3.7×10^{-2}	2.5×10^{-2}	NDA	-
Pu-238	5.7×10^{-5}	2.2×10^{-4}	6.8×10^{-4}	7.4×10^{-4}
Pu-239	2.5×10^{-5}	7.4×10^{-5}	6.4×10^{-5}	1.2×10^{-4}
Natural				
K-40	2.9×10^{0}	1.0×10^{0}	8.0×10^{-1}	3.2×10^{-1}
Po-210	2.6×10^{-2}	1.4×10^{-2}	9.1×10^{-3}	2.9×10^{-3}
Pb-210	2.0×10^{-2}	7.9×10^{-2}	-1.1×10^{-2}	7.2×10^{-2}
Pb-214	6.0×10^{-2}	-	NDA	-
Bi-214	7.0×10^{-2}	-	NDA	-
Ra-226	1.0×10^{-2}	8.8×10^{-3}	3.8×10^{-3}	2.3×10^{-3}
Th-227	5.1×10^{-4}	2.6×10^{-4}	2.4×10^{-4}	2.7×10^{-4}
Th-228	1.8×10^{-3}	1.5×10^{-3}	-3.0×10^{-4}	8.2×10^{-4}
Th-230	2.4×10^{-3}	1.7×10^{-3}	4.9×10^{-4}	3.3×10^{-4}
Th-232(1)	8.0×10^{-2}	-	NDA	-
Th-232(2)	1.7×10^{-3}	1.5×10^{-3}	1.8×10^{-4}	2.6×10^{-5}
U-234	4.0×10^{-3}	2.1×10^{-3}	1.8×10^{-2}	9.7×10^{-3}
U-235	3.2×10^{-4}	3.0×10^{-4}	6.5×10^{-4}	1.8×10^{-4}
U-238	2.2×10^{-3}	9.4×10^{-4}	1.2×10^{-2}	6.6×10^{-3}
Gross Alpha Analysis	-1.1×10^{-1}	9.8×10^{-2}	-3.1×10^{-1}	3.0×10^{-1}
Gross Beta Analysis	3.7×10^{0}	9.3×10^{-1}	6.9×10^{0}	6.2×10^{0}

Notes to Table:

(1) Gamma Scan
(2) Specific Analysis
NDA = No Detectable Activity

TABLE 33
COMPARISON OF RADIONUCLIDE ANALYSES FOR SEDIMENT, AREAS 1 AND 4
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Radionuclides	Area 1		Area 4	
Man-Made	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.
Mn-54	1.7×10^{-2}	-	NDA	-
Co-60	NDA	-	1.9×10^{-2}	-
Sr-90	5.5×10^{-2}	4.0×10^{-2}	-2.5×10^{-2}	6.5×10^{-2}
Cs-134	NDA	-	NDA	-
Cs-137	1.2×10^{-1}	3.4×10^{-2}	9.1×10^{-2}	2.2×10^{-2}
Pu-238	1.2×10^{-2}	6.5×10^{-3}	1.8×10^{-2}	3.8×10^{-2}
Pu-239	4.0×10^{-2}	2.5×10^{-2}	3.9×10^{-2}	2.0×10^{-2}
Natural				
Be-7	1.0×10^{-1}	-	4.4×10^{-1}	-
K-40	$2.0 \times 10^{+1}$	2.3×10^{0}	$2.0 \times 10^{+1}$	3.9×10^{0}
Po-210	2.4×10^{0}	5.4×10^{-1}	2.6×10^{0}	3.8×10^{-1}
Pb-210	3.5×10^{0}	1.4×10^{0}	3.0×10^{0}	1.0×10^{0}
Pb-214	8.3×10^{-1}	1.6×10^{-1}	7.9×10^{-1}	1.5×10^{-1}
Bi-214	7.8×10^{-1}	1.7×10^{-1}	7.5×10^{-1}	8.2×10^{-2}
Ra-226	1.0×10^{0}	2.9×10^{-1}	9.7×10^{-1}	1.3×10^{-1}
Th-227	2.4×10^{-1}	1.3×10^{-1}	1.6×10^{-1}	7.3×10^{-2}
Th-228	1.0×10^{0}	2.2×10^{-1}	1.0×10^{0}	1.0×10^{-1}
Th-230	1.1×10^{0}	2.1×10^{-1}	1.2×10^{0}	2.4×10^{-1}
Th-232(1)	8.4×10^{-1}	1.1×10^{-1}	8.8×10^{-1}	7.0×10^{-2}
Th-232(2)	1.2×10^{0}	2.2×10^{-1}	1.3×10^{0}	2.8×10^{-1}
U-234	1.1×10^{0}	3.8×10^{-1}	1.0×10^{0}	1.7×10^{-1}
U-235	4.6×10^{-2}	2.8×10^{-2}	3.8×10^{-2}	1.4×10^{-2}
U-238	1.0×10^{0}	2.9×10^{-1}	9.9×10^{-1}	1.2×10^{-1}
Gross Alpha Analysis	8.4×10^{0}	3.6×10^{0}	5.2×10^{0}	3.5×10^{0}
Gross Beta Analysis	$3.9 \times 10^{+1}$	7.6×10^{0}	$4.0 \times 10^{+1}$	4.8×10^{0}

Notes to Table:

(1) Gamma Scan
(2) Specific Analysis.
NDA = No Detectable Activity

were no differences in the radionuclide concentrations in the two areas, two values each of Cs-137 and Pu-239 would be found to be significantly higher from a total of 40 observations in Area 1. The results showed that seventeen analyses for Cs-137 and two analyses for Pu-239 were significantly higher than the mean of Area 4. Thus, a higher than expected proportion of Cs-137 observations from Area 1 were significantly higher than the mean of Area 4. It is important to note here that ten of the seventeen "significant for Cs-137" samples were analyzed on board the ANTELOPE upon collection. As stated on page 74 of this report, no elevated (above ambient ranges) levels of Cs-137 were detected. Also, the range of Cs-137 activity in these seventeen samples corresponds to ambient levels of Cs-137 in coastal sediments.[17]

Area 1 Biota Samples

A more detailed Student-t test was used to compare the levels of activity from Area 1 samples to those of Area 4. This test was more specific than that originally conducted by EERF because the radionuclide analysis results were grouped into demersal (living on or near the sea bottom) and pelagic (free swimming) biota categories within each survey area. The data were not further separated by subareal locations of Area 1, as was done to evaluate the sediment data, because the biota sampling during the survey was not specifically confined to subareas and because of normal ecological migrations within the entire sampling area. Nuclides compared in this test were: Co-60, Cs-137, Pu-238, Pu-239 and Sr-90. No statistically significant differences between the two areas were found.

Area 2 and 3 Sediment and Biota Samples

Radionuclide analyses results from survey Areas 2 and 3 were also compared to the data from the control/baseline reference area (Area 4). Tables 34, 35, and 36 present the mean activity for edible and nonedible biota and sediment samples obtained from these three areas. No elevated (abnormal) values of activity were found. Statistical tests were also used to evaluate Area 2 and Area 3 radionuclide analysis results. Duncan's multiple range test was used to compare both sediment and biota data from each of these areas to the data from Area 4. Nuclides compared for sediment samples were: Cs-137, Pu-238, Pu-239 and Sr-90. There were no significant differences in the mean activity levels for sediment samples from either of Areas 2 or 3 when compared to the mean activity levels for Area 4 sediment samples. In comparing biota data, the activity results were grouped into demersal and pelagic categories for each area. There were no significant results in comparing demersal or pelagic biota radionuclide analyses among Areas 2, 3, or 4.

TABLE 34
COMPARISON OF RADIONUCLIDE ANALYSES FOR EDIBLE BIOTA, AREAS 2, 3, AND 4
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Radionuclides	Area 2		Area 3		Area 4	
	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.
Man-Made						
Co-60	1.4×10^{-2}	3.5×10^{-3}	NDA	-	2.0×10^{-2}	-
Sr-90	2.1×10^{-3}	1.2×10^{-3}	-2.6×10^{-4}	2.4×10^{-4}	-1.4×10^{-3}	2.9×10^{-3}
Cs-137	NDA	-	NDA	-	1.6×10^{-2}	-
Pu-238	2.5×10^{-3}	2.9×10^{-3}	1.7×10^{-4}	1.5×10^{-5}	6.6×10^{-4}	6.0×10^{-4}
Pu-239	8.7×10^{-4}	9.2×10^{-4}	3.7×10^{-4}	3.7×10^{-4}	2.7×10^{-4}	4.1×10^{-4}
Natural						
K-40	3.3×10^{0}	7.4×10^{-1}	3.3×10^{0}	3.9×10^{-1}	2.9×10^{0}	6.3×10^{-1}
Po-210	1.6×10^{-1}	1.8×10^{-1}	3.8×10^{-2}	5.9×10^{-2}	8.5×10^{-2}	8.0×10^{-2}
Pb-210	-8.6×10^{-2}	1.5×10^{-1}	1.4×10^{-1}	1.3×10^{-1}	1.9×10^{-2}	1.3×10^{-1}
Pb-214	NDA	-	NDA	-	NDA	-
Bi-214	NDA	-	NDA	-	NDA	-
Ra-226	8.3×10^{-3}	7.5×10^{-3}	3.8×10^{-3}	2.9×10^{-3}	9.7×10^{-3}	9.9×10^{-3}
Th-227	1.1×10^{-3}	1.2×10^{-3}	3.6×10^{-4}	5.1×10^{-4}	4.8×10^{-3}	1.4×10^{-2}
Th-228	2.7×10^{-3}	2.9×10^{-3}	1.2×10^{-3}	1.3×10^{-3}	2.9×10^{-2}	9.2×10^{-2}
Th-230	3.0×10^{-3}	3.4×10^{-3}	1.1×10^{-3}	1.3×10^{-3}	2.5×10^{-2}	8.1×10^{-2}
Th-232(1)	NDA	-	NDA	-	NDA	-
Th-232(2)	3.0×10^{-3}	3.6×10^{-3}	1.3×10^{-3}	1.3×10^{-3}	2.7×10^{-2}	8.8×10^{-2}
U-234	1.1×10^{-2}	1.0×10^{-3}	9.6×10^{-4}	1.1×10^{-4}	6.1×10^{-3}	5.8×10^{-3}
U-235	5.3×10^{-4}	1.9×10^{-4}	9.2×10^{-5}	8.4×10^{-5}	4.3×10^{-4}	8.1×10^{-4}
U-238	8.2×10^{-3}	5.0×10^{-4}	8.6×10^{-4}	3.9×10^{-4}	6.4×10^{-3}	6.1×10^{-3}
Gross Alpha Analysis	-4.5×10^{-2}	6.4×10^{-2}	-8.8×10^{-2}	2.7×10^{-1}	-2.2×10^{-1}	3.9×10^{-1}
Gross Beta Analysis	3.4×10^{0}	9.2×10^{-1}	5.2×10^{0}	3.7×10^{0}	8.9×10^{0}	7.2×10^{0}

Notes to Table:

(1) Gamma Scan
(2) Specific Analysis
NDA = No Detectable Activity

TABLE 35
COMPARISON OF RADIONUCLIDE ANALYSES FOR
NONEDIBLE BIOTA, AREAS 2, 3, AND 4
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Radionuclides	Area 2		Area 3		Area 4	
Man-Made	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.
Co-60	NDA	-	NDA	-	NDA	-
Sr-90	-7.0×10^{-4}	-	NDA	-	-7.5×10^{-3}	2.5×10^{-3}
Cs-137	5.0×10^{-3}	-	NDA	-	NDA	-
Pu-238	7.2×10^{-1}	-	3.1×10^{-4}	-	6.8×10^{-4}	7.4×10^{-4}
Pu-239	4.3×10^{-3}	-	1.2×10^{-4}	-	6.4×10^{-5}	1.2×10^{-4}
Natural						
K-40	1.4×10^{0}	-	1.3×10^{0}	6.8×10^{-1}	8.0×10^{-1}	3.2×10^{-1}
Po-210	9.8×10^{-2}	-	2.8×10^{-3}	-	9.1×10^{-3}	2.9×10^{-3}
Pb-210	-7.4×10^{-3}	-	9.0×10^{-3}	-	-1.1×10^{-2}	7.2×10^{-2}
Pb-214	NDA	-	NDA	-	NDA	-
Bi-214	NDA	-	NDA	-	NDA	-
Ra-226	8.0×10^{-3}	-	6.0×10^{-3}	-	3.8×10^{-3}	2.3×10^{-3}
Th-227	1.6×10^{-3}	-	1.6×10^{-3}	-	2.4×10^{-4}	2.7×10^{-4}
Th-228	2.0×10^{-2}	-	9.7×10^{-3}	-	-3.0×10^{-4}	8.2×10^{-4}
Th-230	2.0×10^{-2}	-	3.8×10^{-3}	-	4.9×10^{-4}	3.3×10^{-4}
Th-232(1)	NDA	-	NDA	-	NDA	-
Th-232(2)	1.0×10^{-2}	-	3.6×10^{-3}	-	1.8×10^{-4}	2.6×10^{-5}
U-234	1.1×10^{-2}	-	1.1×10^{-2}	-	1.8×10^{-2}	9.7×10^{-3}
U-235	3.2×10^{-4}	-	8.0×10^{-4}	-	6.5×10^{-4}	1.8×10^{-4}
U-238	7.2×10^{-3}	-	7.6×10^{-3}	-	1.2×10^{-2}	6.6×10^{-3}
Gross Alpha Analysis	1.0×10^{-1}	-	0.0×10^{-1}	8.2×10^{-3}	-3.1×10^{-1}	3.0×10^{-1}
Gross Beta Analysis	2.2×10^{0}	-	1.8×10^{0}	1.2×10^{0}	6.9×10^{0}	6.2×10^{0}

Notes to Table:

(1) Gamma Scan
(2) Specific Analysis
NDA = No Detectable Activity

TABLE 36
COMPARISON OF RADIONUCLIDE ANALYSES FOR SEDIMENT, AREAS 2, 3, AND 4
EPA RADIOLOGICAL MONITORING SURVEY, MASSACHUSETTS BAY 1982

Radionuclides	Area 2		Area 3		Area 4	
Man-Made	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.	Mean Activity (pCi/g Wet)	STD. DEV.
Mn-54	8.6×10^{-3}	-	1.5×10^{-2}	-	NDA	-
Co-60	NDA	-	NDA	-	1.9×10^{-2}	-
Sr-90	5.4×10^{-2}	1.1×10^{-2}	7.2×10^{-2}	5.0×10^{-2}	-2.5×10^{-2}	6.5×10^{-2}
Cs-134	5.0×10^{-2}	-	NDA	-	NDA	-
Cs-137	6.1×10^{-2}	2.7×10^{-2}	1.1×10^{-1}	1.1×10^{-1}	9.1×10^{-2}	2.2×10^{-2}
Pu-238	1.4×10^{-2}	1.1×10^{-2}	1.0×10^{-2}	1.1×10^{-2}	1.8×10^{-2}	3.8×10^{-2}
Pu-239	2.5×10^{-2}	1.2×10^{-2}	3.2×10^{-2}	1.0×10^{-2}	3.9×10^{-2}	2.0×10^{-2}
Natural						
Be-7	NDA	-	NDA	-	4.4×10^{-1}	-
K-40	$2.0 \times 10^{+1}$	6.2×10^{0}	$2.1 \times 10^{+1}$	4.8×10^{0}	$2.0 \times 10^{+1}$	3.9×10^{0}
Po-210	1.9×10^{0}	1.0×10^{-1}	1.9×10^{0}	3.1×10^{-1}	2.6×10^{0}	3.8×10^{-1}
Pb-210	1.0×10^{0}	8.5×10^{-1}	1.6×10^{0}	5.2×10^{-1}	3.0×10^{0}	1.0×10^{0}
Pb-214	8.8×10^{-1}	1.8×10^{-1}	7.8×10^{-1}	1.4×10^{-1}	7.9×10^{-1}	1.5×10^{-1}
Bi-214	8.2×10^{-1}	1.7×10^{-1}	7.4×10^{-1}	1.4×10^{-1}	7.5×10^{-1}	8.2×10^{-2}
Ra-226	9.2×10^{-1}	1.5×10^{-1}	9.9×10^{-1}	1.2×10^{-1}	9.7×10^{-1}	1.3×10^{-1}
Th-227	1.8×10^{-1}	3.1×10^{-2}	2.1×10^{-1}	6.6×10^{-2}	1.6×10^{-1}	7.3×10^{-2}
Th-228	8.8×10^{-1}	1.2×10^{-1}	1.0×10^{0}	1.5×10^{-1}	1.0×10^{0}	1.0×10^{-1}
Th-230	8.3×10^{-1}	1.4×10^{-1}	1.1×10^{0}	2.0×10^{-1}	1.2×10^{0}	2.4×10^{-1}
Th-232(1)	8.8×10^{-1}	2.1×10^{-1}	8.6×10^{-1}	1.9×10^{-1}	8.8×10^{-1}	7.0×10^{-2}
Th-232(2)	1.0×10^{0}	1.4×10^{-1}	1.2×10^{0}	2.0×10^{-1}	1.3×10^{0}	2.8×10^{-1}
U-234	6.9×10^{-1}	2.7×10^{-1}	1.0×10^{0}	2.0×10^{-1}	1.0×10^{0}	1.7×10^{-1}
U-235	5.5×10^{-2}	3.5×10^{-2}	4.5×10^{-2}	1.4×10^{-2}	3.8×10^{-2}	1.4×10^{-2}
U-238	7.1×10^{-1}	1.7×10^{-1}	8.4×10^{-1}	1.4×10^{-1}	9.9×10^{-1}	1.2×10^{-1}
Gross Alpha Analysis	6.9×10^{0}	3.3×10^{0}	5.8×10^{0}	2.9×10^{0}	5.2×10^{0}	3.5×10^{0}
Gross Beta Analysis	$3.6 \times 10^{+1}$	5.2×10^{0}	$3.8 \times 10^{+1}$	6.7×10^{0}	$4.0 \times 10^{+1}$	4.8×10^{0}

Notes to Table:

(1) Gamma Scan
(2) Specific Analysis
NDA = No Detectable Activity

In summary, all activity levels for radionuclides identified in sediment and biota samples from designated disposal Areas 1, 2 and 3 were statistically compared to the activity levels of nuclides from the reference area samples (Area 4). For man-made nuclides in sediment, only Cs-137 was found to be significantly different, statistically, in Area 1 than in Area 4. No other man-made nuclides were found to be significantly different. Although the Cs-137 activity is statistically significant in comparing Area 1 to Area 4, there is no apparent significance from a public health perspective since the activity levels for Cs-137 are within the ranges of previously reported environmental background (ambient) data.[9][17]

EPA has included all radionuclide analysis data for samples collected during the 1982 radiological monitoring survey in Appendix D for those readers who may wish to perform additional statistical evaluations or verify EPA's procedures. Appendix D data is summarized in Appendix E, which also includes summaries of data presented in Appendices B and C.

EPA/FDA Marketplace Seafood Program

A summary of EERF radionuclide analysis data appears earlier in this report, in Table 5. It is notable that 23 of the 90 analyses for cesium-137, strontium-90, plutonium-238, and plutonium-239 provide either nondetectable or negative values. The remaining analyses results are essentially the same as normal environmental background or ambient radiation data, and the values reported from samples obtained from NOAA and EPA sampling surveys in the Bay. The results from the WEAC analyses of the Boston seafood samples are given in Table 6. No iodine-131, barium-140, strontium-90, or plutonium-239 was detected. Cesium-137 was observed above detection limits in 5 of the 12 samples. The levels of cesium-137 that were observed are in the same range as those observed during the past 10 years in the FDA Total Diet Studies Program samples and in the imported food samples analyzed by FDA in its Radionuclides in Foods Program. Although the cesium-137 concentrations are at a measurable level, the results are all far below levels considered by the FDA to be of public health concern. In summary, these cesium-137 values are considered as normal background and attributable to fallout.

The results of analyses by EERF of the 12 sample splits were compared with the WEAC analyses. Differences between labs in sensitivity of analyses and in normal procedures for reporting analytical uncertainties made direct comparison of the values difficult. Both data sets clearly show, however, that the levels of radionuclides present are at or below levels normally found in foods. Additionally, all the data were found to be in the lower part of Range I of the Federal Radiation Council Guidelines and are similar to findings from FDA analyses of imported fish obtained at retail outlets.[11]

CONCLUSIONS

Based upon the extensive radionuclide analyses data presented in this report, EPA concludes that:

- Samples of sediment and biota obtained by NOAA and SAI in 1981 and 1982, and analyzed by EPA, contained environmental background or ambient radiation activity levels.
- Seafoods analyzed from the 1981-1982 EPA/FDA marketplace sampling program in Boston contained levels of radionuclide activity that are at or below those levels normally found in foods.
- Sediment and biota samples, measured for gamma radiation on board ANTELOPE during the 1982 EPA radiological monitoring survey, contained environmental background or ambient radiation activity levels.
- The _in-situ_ gamma radiation detector that was deployed within the baseline reference area and designated LLW disposal sites during the 1982 EPA radiological monitoring survey recorded no radiation above environmental background levels.
- Results of detailed radiochemical analyses by the EPA Eastern Environmental Radiation Facility for sediment and biota samples collected during the 1982 EPA radiological monitoring survey, from a baseline reference area and designated LLW disposal sites, show that, except for Cs-137 in sediment samples from Area 1, there were no statistically significant difference in activity levels. Furthermore, all activity levels, including Cs-137 in sediment samples from Area 1, are within previously reported levels of environmental background or ambient radiation. All data results provided no evidence of contamination within survey areas 1, 2, and 3 from any source other than global fallout. Previous disposal of packaged radioactive wastes have not led to contamination of the sedimentary or biotic environment within the disposal sites.

The overall conclusion then is that the data show no evidence that past disposals of LLW in Massachusetts Bay are resulting in contamination of the area with waste-related radionuclides. This conclusion is in accord with the preliminary data presented from the 1982 EPA radiological monitoring survey and with previous EPA findings at other major U.S. ocean LLW disposal sites.[12]

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Special thanks also to computer specialist Keith McCroan and statistician Jon Broadway of EERF, for formatting and summarizing the data presented in the Appendices, and to Phil Cuny and You-Yen Yang of EPA for providing statistical analyses of the data.

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Also, the efforts of the FDA, Department of Health and Human Services, to collect and analyze marketplace seafood samples are sincerely appreciated.

Final recognition is accorded to Raymond Johnson of EPA. Each of the studies described in this report were accomplished under his supervisory direction. In particular, he established survey objectives and provided specific guidance for the detailed planning of the radiological monitoring survey. In addition, his editorial review of the draft version of this report, especially with regard to the analysis of data presented, was conducive to its publication.

Scientific Personnel
1982 EPA Radiological Monitoring Survey in Massachusetts Bay

William Bell	Massachusetts Department of Public Health
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APPENDIX A

PRE-SURVEY PLAN FOR
EPA RADIOLOGICAL MONITORING SURVEY IN
MASSACHUSETTS BAY, SEPTEMBER 1982

SURVEY CRUISE PLAN

Location Massachusetts Bay

Dates 17 - 30 September 1982

Background

Sea disposal of low-level radioactive wastes began in 1946 under the licensing and contracting authority of the former Atomic Energy Commission. The Environmental Protection Agency has determined that approximately 108,000 containers of low-level radioactive wastes were dumped at sites in the Atlantic and Pacific oceans between 1946 and 1970. Approximately 4,000 of these containers were disposed of in Massachusetts Bay between 1946 and 1962. Records provided by the Nuclear Regulatory Commission indicate three areas in the Bay, selected for waste dumping by the Army Corps of Engineers, where radioactive waste disposal may have occurred. Most of these disposals are believed to have been in a circular area designated on nautical charts as the "Foul Area" dumpsite. Each area has also been used for disposal of other wastes, including: dredge spoils, munitions, construction debris, and chemical and industrial materials.

During 1981, new concerns were raised for potential adverse effects to public health from the previous disposals of radioactive wastes in Massachusetts Bay. As a result, the House of Representatives Subcommittee on Oceanography conducted hearings on September 21, 1981, in Boston with regard to radioactive waste disposal in the Bay.

Also in 1981, the EPA requested the National Oceanic and Atmospheric Administration to perform a side-scan sonar survey of the three areas in the Bay considered as most likely dumping areas for low-level radioactive wastes (see areas 1, 2 and 3, Figure 1). That survey, conducted in September and October 1981, located and charted a large number of bottom objects in those dumpsite areas. Side-scan sonar data (sonographs) showed both natural (geological) features and many presumably man-made objects, some of which may be radioactive waste containers.

Purpose

This survey will respond to concerns for additional information about previous disposals of low-level radioactive wastes in Massachusetts

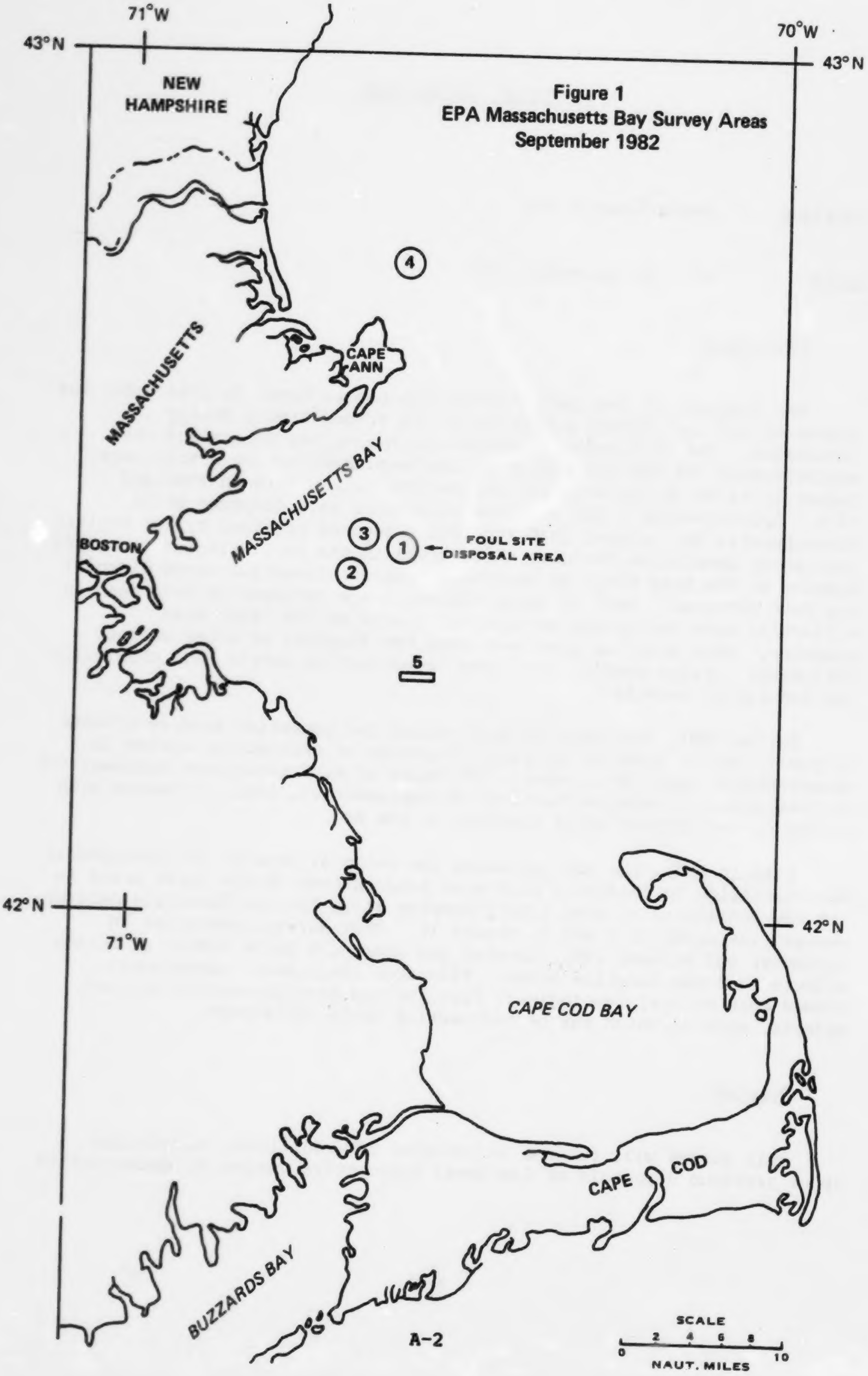


Figure 1
EPA Massachusetts Bay Survey Areas
September 1982

71°W
43° N
70°W
43° N
NEW HAMPSHIRE
MASSACHUSETTS
CAPE ANN
MASSACHUSETTS BAY
BOSTON
4
3
1
FOUL SITE DISPOSAL AREA
2
5
42° N
71°W
42° N
CAPE COD BAY
CAPE COD
BUZZARDS BAY
SCALE
0
2
4
6
8
10
NAUT. MILES

Bay that were expressed by the Subcommittee on Oceanography. It will supplement the 1981 NOAA side-scan sonar survey of areas 1, 2 and 3, acquire baseline reference data from area 4 for comparison with dumpsite data, and survey area 5 which was not previously studied (see Figure 1). Its intent is to accumulate sufficient data to describe the radiological environment within these areas and to allay public concerns about potential health effects from the previous disposals in the Bay. Three objectives are planned, as follows:

(1) to identify bottom objects, observed during the previous side-scan sonar survey, using an underwater television system and 35 mm photographs;

(2) to acquire in-situ radiation measurements near identifiable radioactive waste containers, and at selected intervals in the dumping areas, using an underwater radiation detector; and

(3) to obtain a thorough, uniformly spaced series of biota and sediment samples from within each dumping area for radionuclide analysis by the EPA Eastern Environmental Radiation Facility in Montgomery, Alabama.

Ship EPA Ocean Survey Vessel ANTELOPE

Schedule

	17 September	Depart from Annapolis, Maryland
	19 September	Arrive in Massachusetts Bay/Commence Survey
(am)	20 September	Conduct Press Briefing & Open House in Boston
(pm)	20 September	Depart Boston/Continue Survey
	29 September	Complete Survey
		Offload TV & Side-Scan Equipment/Personnel in Boston
		Commence Transit to Annapolis
	30 September	Arrive in Annapolis, Maryland

Equipment and Source

The following items will be required to be onboard and operational prior to sailing from Annapolis in order to fulfill the survey objectives.

LORAN-C Navigational System	OSV ANTELOPE
Del Norte Navigational System	Science Applications, Inc.
Underwater Radiation Detector	EPA Eastern Environmental Radiation Facility
Shipboard Radiation Measuring Equipment	EPA Eastern Environmental Radiation Facility
Sediment/Biota Sample Containers	EPA Eastern Environmental Radiation Facility
Box Coring Sediment Sampler	OSV ANTELOPE
Smith-McIntyre Sediment Sampler	OSV ANTELOPE
Benthic Biota Trawls/Dredges	OSV ANTELOPE
Mid-Water (Nektonic) Biota Trawls	OSV ANTELOPE
Planktonic Sampling Equipment	OSV ANTELOPE
Scale to weigh biota	OSV ANTELOPE
Field Microscope	OSV ANTELOPE
Underwater Television System	Science Applications, Inc.
35 mm Underwater Camera System	OSV ANTELOPE
Survey Documentation TV System and 35 mm Camera/Film	EPA Office of Public Awareness
Side-Scan Sonar Profiling System	Science Applications, Inc.
Precision Fathometer	OSV ANTELOPE
Deck Machinery (Winches, Cranes, etc.) and Operators	OSV ANTELOPE
Scientific Freezer Storage	OSV ANTELOPE

The following items should be onboard and operational prior to sailing from Annapolis for optional use during this survey.

CTD Water Profiling System	OSV ANTELOPE
Rosette Array with large GO-FLOW Sample Bottles	OSV ANTELOPE

Salinometer	OSV ANTELOPE
Turbidometer	OSV ANTELOPE
XBT System	OSV ANTELOPE

Survey Areas (see Figure 1)

Area 1

Massachusetts Bay

Listed on nautical charts as "Foul Area"

Industrial Waste Dumpsite

Surveyed with Side-Scan Sonar, fall 1981

A one-nautical mile radius circular area, central coordinates:

42 degrees, 25.7 minutes North latitude

70 degrees, 35.0 minutes West longitude

Water Depth: approximately 300 feet

Area 2

Massachusetts Bay

Surveyed with Side-Scan Sonar, fall 1981

A one-nautical mile radius circular area, central coordinates:

42 degrees, 23.3 minutes North latitude

70 degrees, 40.6 minutes West longitude

Water Depth: approximately 200 feet

Area 3

Massachusetts Bay

Surveyed with Side-Scan Sonar, fall 1981

A one nautial mile radius circular area, central coordinates:

42 degrees, 26.9 minutes North latitude

70 degrees, 40.0 minutes West longitude

Water Depth: approximately 200 feet

Area 4

Northeast of Cape Ann, Massachusetts

Selected as Baseline Reference Area

A one-nautical mile radius circular area, central coordinates:

42 degrees, 45.5 minutes North latitude

70 degrees, 32.3 minutes West longitude

Water Depth: approximately 300 feet

Area 5

Massachusetts Bay

Listed on nautical charts as "Discontinued Dumping Ground"

An approximately one-square nautical mile rectangular area, central coordinates:

42 degrees, 16.4 minutes North latitude

70 degrees, 33.5 minutes West longitude

Water Depth: approximately 200 feet

Survey Procedures

Upon arriving in the Massachusetts Bay vicinity on 19 September, the ANTELOPE will proceed north of Cape Ann to Area 4. There the underwater television and side-scan sonar systems will be deployed while a series of cross lines is traversed in this baseline reference area to determine that no dumping of wastes has occurred. The underwater radiation detector will also be lowered at selected intervals to acquire background level readings for use in comparison with radiation measurements to be performed later during this survey in dumpsite areas.

ANTELOPE will then transit to Boston to prepare for the press briefing and open house scheduled for the morning of 20 September. During the afternoon of 20 September, ANTELOPE will depart Boston to continue this survey.

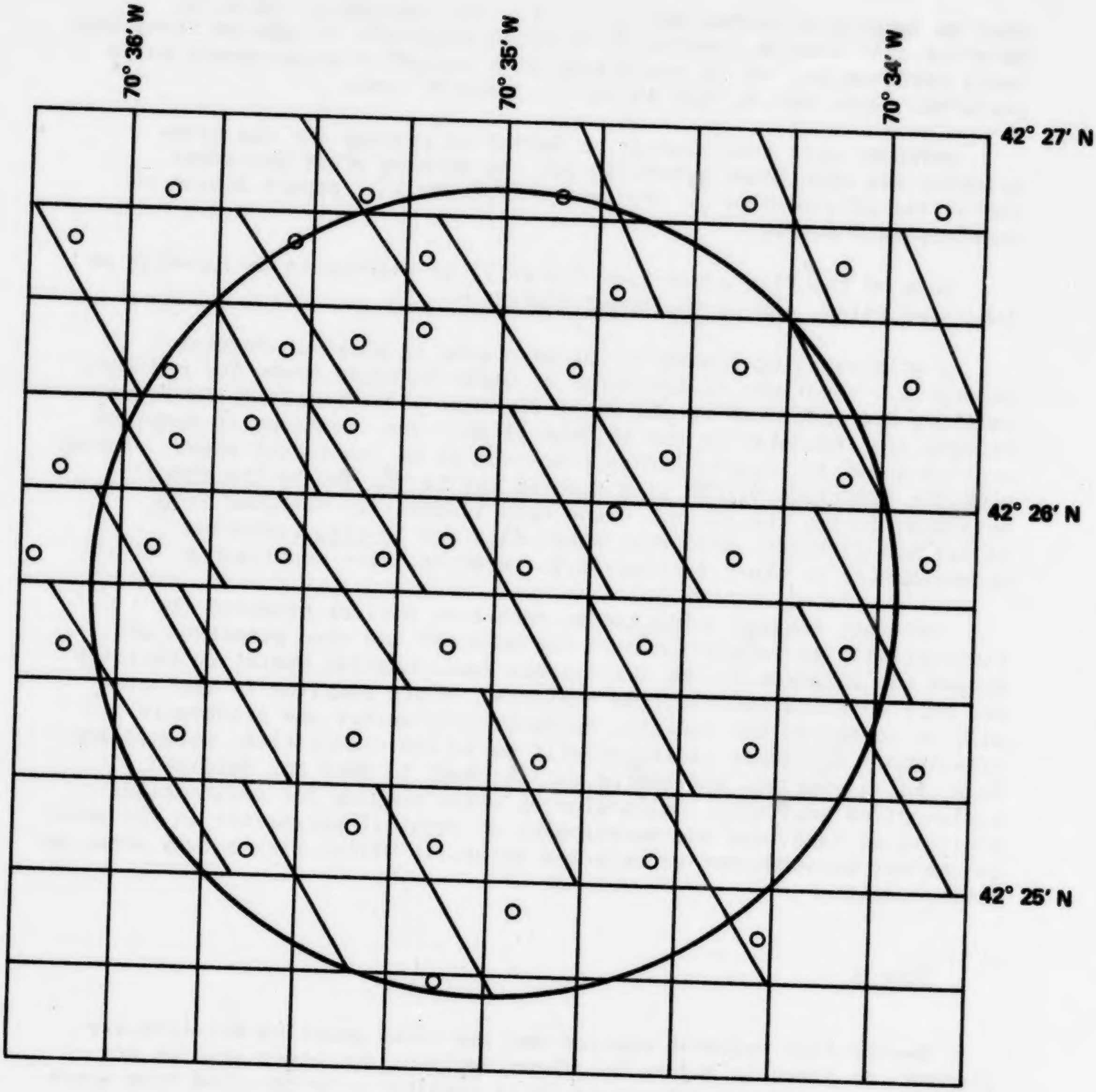
Each of the five areas (see Figure 1) is planned to be surveyed as described below, and in the order listed.

A grid-sampling schematic for each area is shown in Figures 2 through 6. Locations of box cores or Smith-McIntyre grabs for sediment sampling are indicated by the small circles; biota sampling trawls and dredges are indicated by the oblique lines. The locations of sampling station shown in Figures 2 thru 6 are not to be considered exact. Actual sampling locations within grid squares may be changed by the chief scientist during the survey, based upon information obtained from television pictures, side-scan sonar data and in-situ radiation measurements, or other factors (e.g., weather, time constraints, etc.).

Sediment samples collected in each area will be measured for radioactivity as brought onboard the ANTELOPE and then preserved and stored for shipment to the EPA Eastern Environmental Radiation Facility for more detailed radionuclide analysis. Biota sampling in each area will be attempted for benthic, nektonic (mid-water) and planktonic organisms. Specimens collected will be sorted, identified, weighed and measured, preserved, and stored for shipment to EERF for detailed radionuclide analysis. Collection of water samples for radionuclide analysis at EERF, and the measurement of physical parameters in the water column may be conducted at selected intervals within each survey area, as time permits.

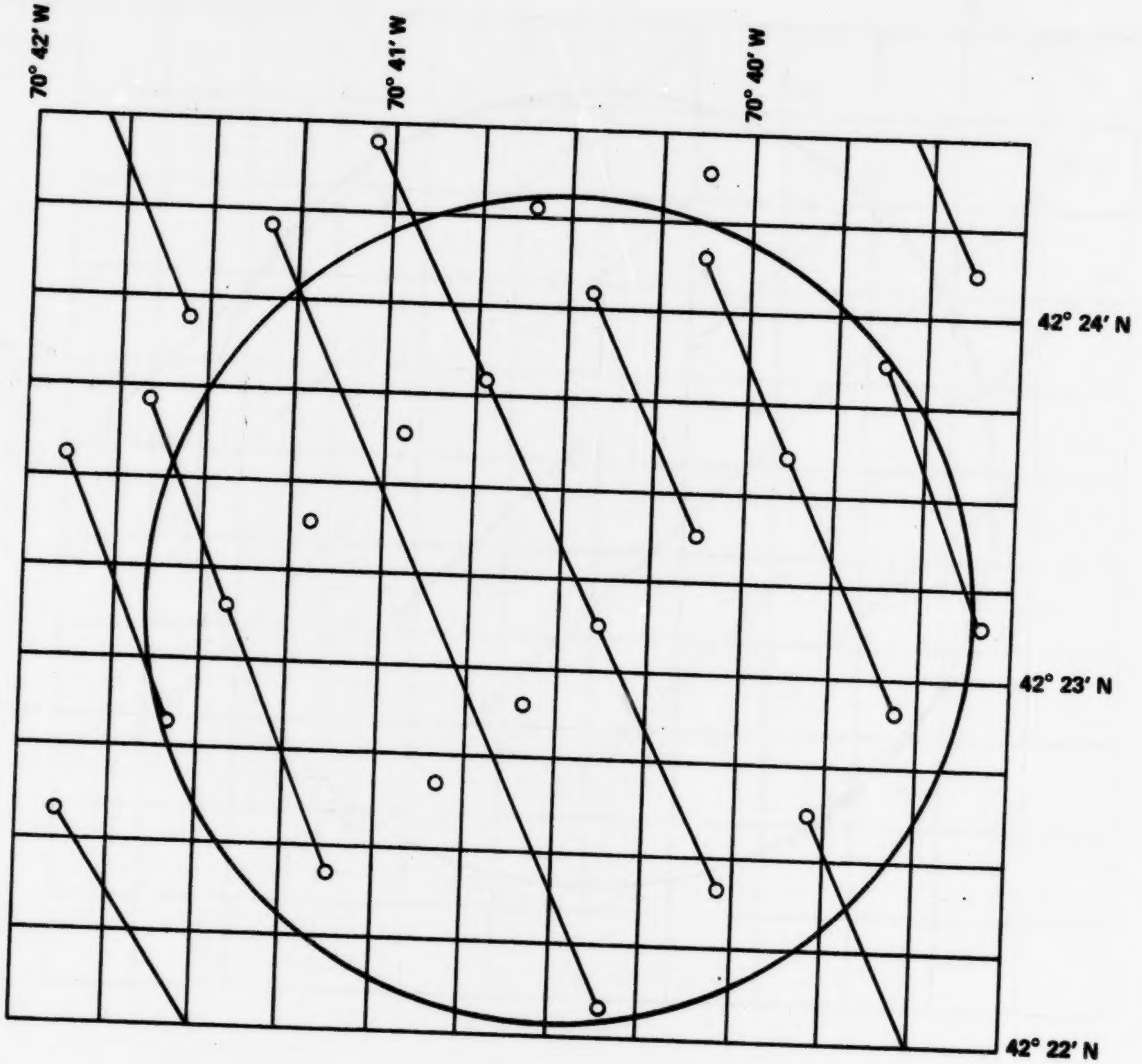
Area 4

Twenty-five sediment samples and ten biota sampling stations are planned, as shown in Figure 5. These sediment and biota samples are being collected for reference to those samples to be obtained from areas 1, 2, 3, and 5. They will also be used to reference previous sediment and biota collections within other areas of Massachusetts Bay by NOAA during April, July, November, and December of 1981.


70° 36′ W
70° 35′ W
70° 34′ W
42° 27′ N
42° 26′ N
42° 25′ N

AREA # 1

FIGURE 2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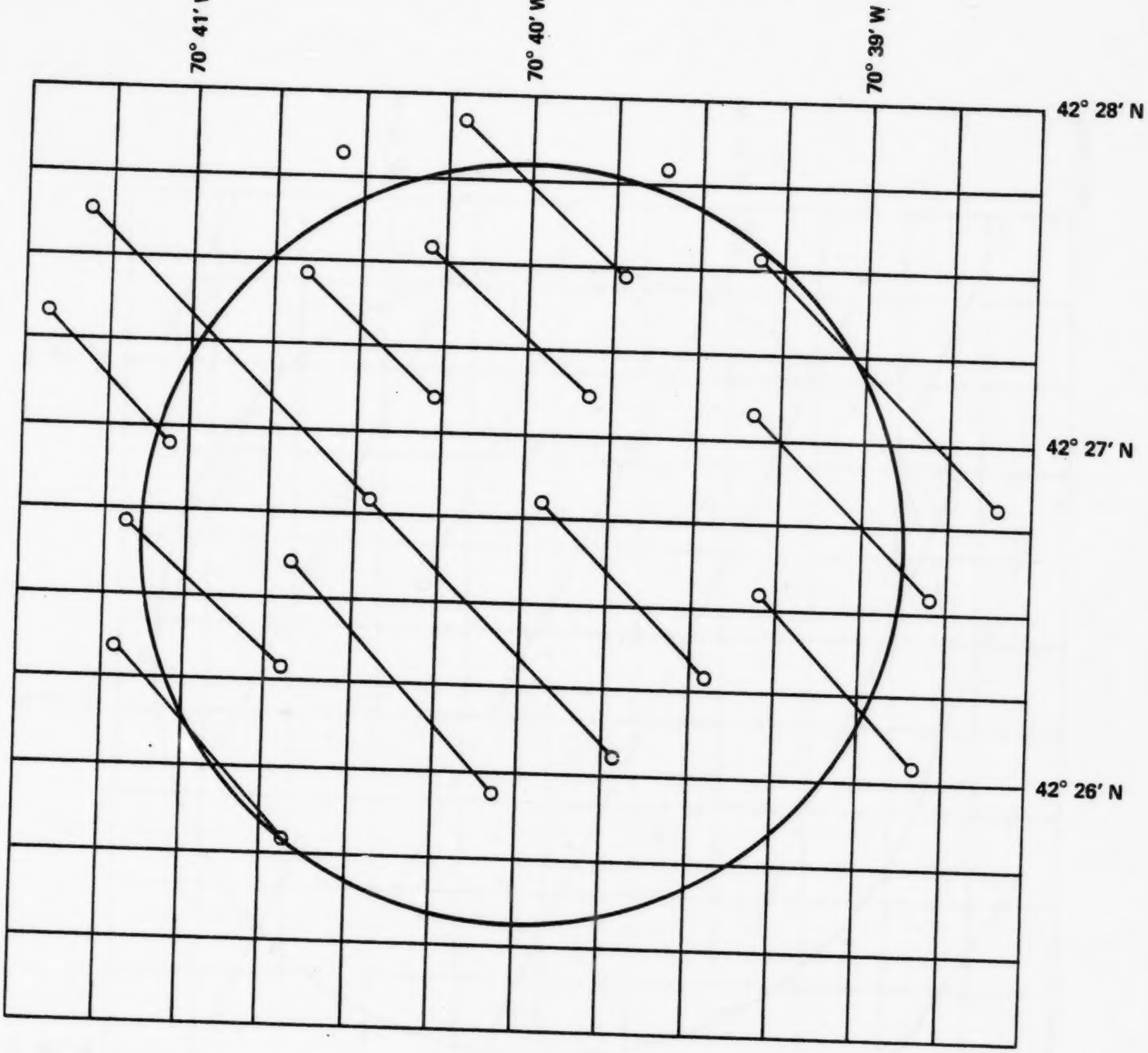
70° 40' W
42° 24' N
42° 23' N
42° 22' N

AREA # 2

FIGURE 3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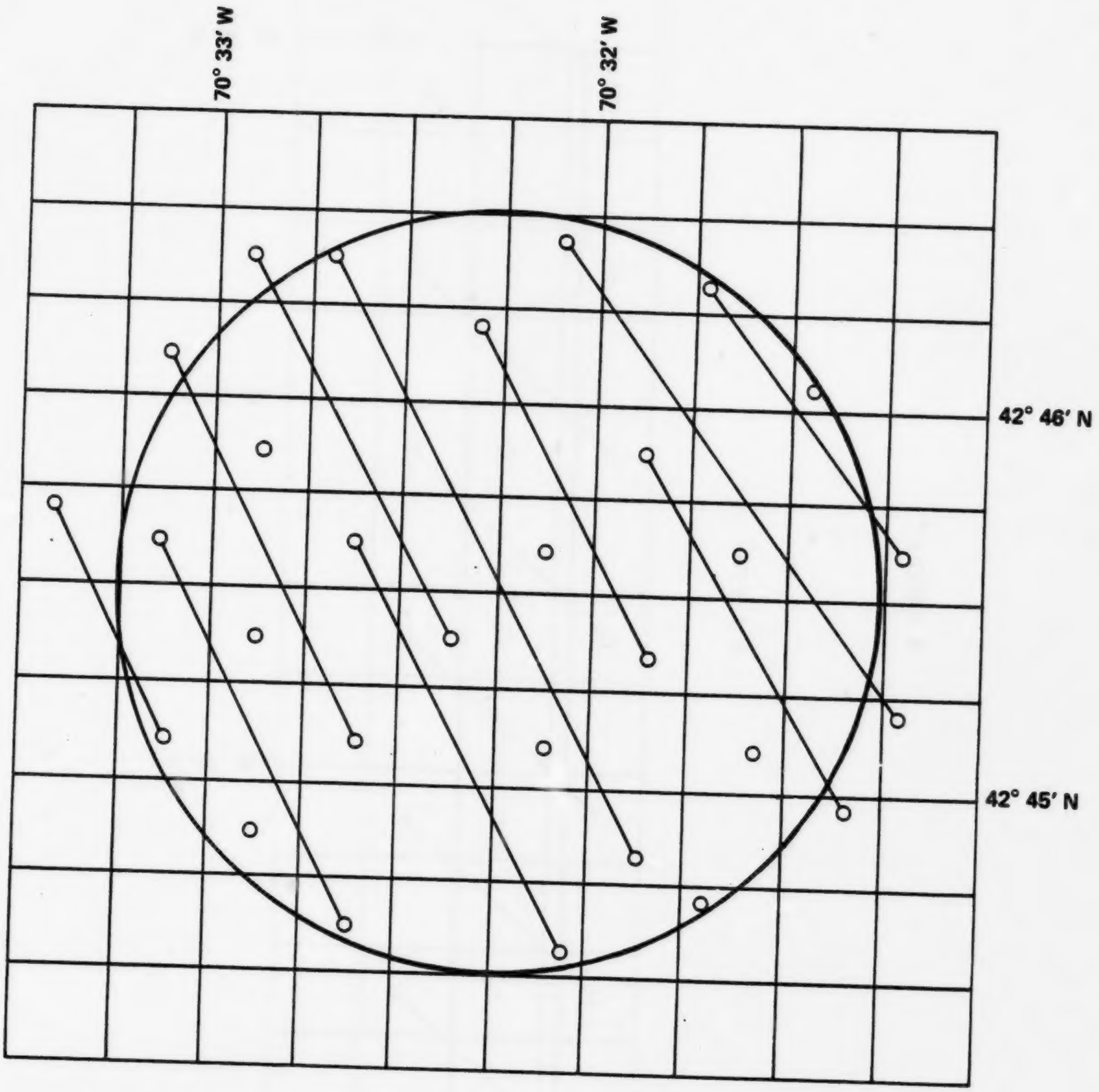
70° 39′ W
42° 28′ N
42° 27′ N
42° 26′ N

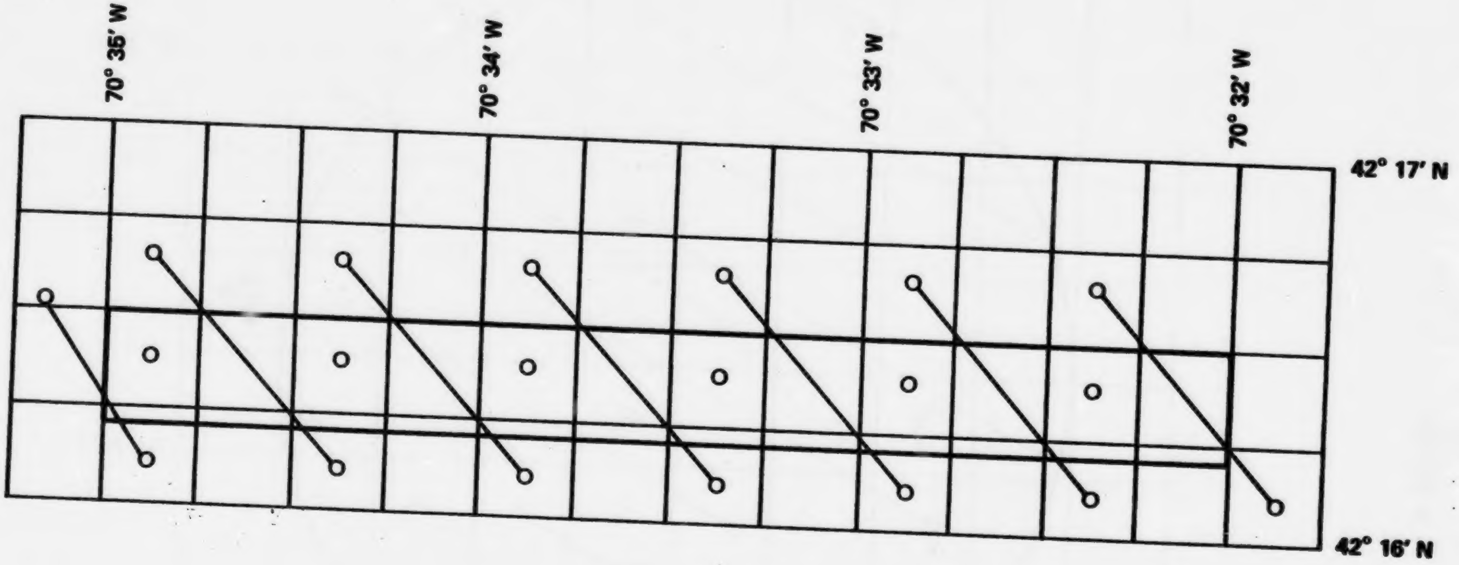
AREA # 3

FIGURE 4


70° 33' W
70° 32' W
42° 46' N
42° 45' N

AREA # 4

FIGURE 5


70° 35' W
70° 34' W
70° 33' W
70° 32' W
42° 17' N
42° 16' N

AREA # 5

FIGURE 6

Area 1

The navigational and side-scan sonar systems will be used to relocate on the side-scan lines previously traversed during the 1981 NOAA survey of this area. The underwater television system will be deployed to identify previously charted bottom objects, and in-situ radiation measurements will be made near those objects which the television indicates may be radioactive waste containers and at selected intervals within the area.

As shown in Figure 2, fifty sediment samples are planned for collection in this area. Twenty-five biota sampling stations are also indicated. The grid-sampling plan for obtaining sediment and biota from this area was designed to: (1) collect a uniformly distributed series of samples and (2) to acquire additional samples in grids for which that the 1981 side-scan records showed a larger concentration of bottom objects.

Area 2

Surveying and sampling this area are to be conducted by the same procedures used in Area 1.

As shown in Figure 3, twenty-eight sediment samples and fifteen biota sampling stations are planned for this area. Rationale for the selection of sampling locations is the same as described in Area 1.

Area 3

Surveying and sampling this area are to be conducted by the same procedures used in Areas 1 and 2.

As shown in Figure 4, twenty-seven sediment samples and thirteen biota sampling stations are planned for this area. Rationale for selecting sampling locations is as described in Area 1.

Area 5

This area was not previously surveyed by side-scan sonar. A series of cross lines with side-scan sonar and underwater television systems deployed will be traversed in this area. In-situ radiation measurements will also be performed.

As shown in Figure 6, twenty sediment samples and seven biota sampling stations are planned. Since this area has not previously been surveyed with side-scan sonar, the rationale in selecting sampling locations was based only on obtaining a uniform distribution of samples.

Survey Reports and End Products

The information that will be available from this survey includes the following:

1) Underwater television tapes
2) 35mm photographs
3) Sonographs (side-scan sonar data)
4) Navigational charts and records
5) Onboard radiation measurement data
6) Radionuclide analysis data (to be performed after the cruise)
7) Comprehensive survey data report(s)
8) Television documentation tapes of survey activities

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EPA Office of Radiation Programs
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August 12, 1982

APPENDIX B

EERF ANALYSES OF BIOTA AND SEDIMENT SAMPLES PROVIDED BY NOAA AND SAI FROM MASSACHUSETTS BAY, 1981-1982

CONTENTS

Edible Biota Samples	B-1 to B-5
Nonedible Biota Samples	B-6 to B-8
Sediment Samples	B-9 to B-18

Radionuclide Analyses of Edible Biota Samples
1981 NOAA Sampling for EPA

Sample Number	Date Collected	Sample Type	Analysis	Nuclide	Activity pCi/g (wet)	2-Sigma Error
	MAN-MADE NUCLIDES					
20344	12/ 1/81	SILVER HAKE	GAMMA	CS-137	2.4000E-02	1.3200E-02
20345	12/ 1/81	HERRING	GAMMA	CS-137	1.6000E-02	1.1840E-02
20349	11/10/81	FOURBEARD ROCKLING	GAMMA	CS-137	2.8000E-02	2.7160E-02
20350	11/10/81	GREY SOLE	GAMMA	CS-137	1.4000E-02	1.0640E-02
20358	12/ 1/81	POLLOCK	GAMMA	CS-137	2.1000E-02	1.7430E-02
20359	12/ 1/81	WHITE HAKE	GAMMA	CS-137	1.6000E-02	1.1040E-02
20362	12/ 3/81	MACKEREL	GAMMA	CS-137	1.6000E-02	1.0080E-02
20370	12/ 3/81	CUSK	GAMMA	CS-137	2.3000E-02	9.2000E-03
20343	12/ 1/81	SHAD	PU	PU-238	1.3000E-04	1.5400E-04
20344	12/ 1/81	SILVER HAKE	PU	PU-238	3.1240E-05	2.7240E-04
20346	12/ 1/81	COD	PU	PU-238	1.0200E-04	2.1690E-04
20352	11/10/81	WHITE HAKE	PU	PU-238	1.4950E-04	2.2360E-04
20355	11/10/81	GOOSEFISH	PU	PU-238	1.1170E-04	1.9520E-04
20358	12/ 1/81	POLLOCK	PU	PU-238	-8.8860E-05	2.5850E-04
20359	12/ 1/81	WHITE HAKE	PU	PU-238	9.3000E-05	1.7438E-04
20361	12/ 1/81	RED HAKE	PU	PU-238	1.4960E-04	3.1800E-04
20362	12/ 3/81	MACKEREL	PU	PU-238	1.6300E-04	1.8940E-04
20366	12/ 3/81	COD	PU	PU-238	7.8040E-05	2.0170E-04
20367	12/ 3/81	COD	PU	PU-238	-9.7170E-05	1.8220E-04
20368	12/ 3/81	COD	PU	PU-238	1.0550E-04	1.4990E-04
20343	12/ 1/81	SHAD	PU	PU-239	3.7150E-05	7.4450E-05
20344	12/ 1/81	SILVER HAKE	PU	PU-239	1.8740E-04	1.5510E-04
20346	12/ 1/81	COD	PU	PU-239	-1.5310E-04	1.6250E-04
20352	11/10/81	WHITE HAKE	PU	PU-239	1.4950E-04	1.2360E-04
20355	11/10/81	GOOSEFISH	PU	PU-239	0.0000E-01	8.9330E-05
20358	12/ 1/81	POLLOCK	PU	PU-239	8.8860E-05	1.3300E-04
20359	12/ 1/81	WHITE HAKE	PU	PU-239	2.3000E-05	4.6090E-05
20361	12/ 1/81	RED HAKE	PU	PU-239	7.4780E-05	2.5930E-04
20362	12/ 3/81	MACKEREL	PU	PU-239	1.0870E-04	2.0380E-04
20366	12/ 3/81	COD	PU	PU-239	1.3010E-04	1.7330E-04
20367	12/ 3/81	COD	PU	PU-239	1.2150E-04	1.4650E-04
20368	12/ 3/81	COD	PU	PU-239	-5.2750E-05	1.2940E-04
20343	12/ 1/81	SHAD	SR	SR-90	1.0000E-03	1.0000E-03
20344	12/ 1/81	SILVER HAKE	SR	SR-90	2.0000E-03	3.0600E-03
20346	12/ 1/81	COD	SR	SR-90	1.0000E-04	3.0000E-04
20352	11/10/81	WHITE HAKE	SR	SR-90	-1.0000E-04	2.0000E-04
20355	11/10/81	GOOSEFISH	SR	SR-90	-2.0000E-04	5.0000E-04
20358	12/ 1/81	POLLOCK	SR	SR-90	1.0000E-03	4.6400E-03
20359	12/ 1/81	WHITE HAKE	SR	SR-90	3.0000E-04	8.0100E-04
20361	12/ 1/81	RED HAKE	SR	SR-90	2.0000E-04	3.0000E-04
20362	12/ 3/81	MACKEREL	SR	SR-90	-5.0000E-04	8.0000E-04
20366	12/ 3/81	COD	SR	SR-90	-3.0000E-04	5.0100E-04
20367	12/ 3/81	COD	SR	SR-90	1.0000E-04	3.0000E-04
20368	12/ 3/81	COD	SR	SR-90	1.0000E-04	2.0000E-04

NATURAL NUCLIDES

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20365  12/ 3/81  COD                 GAMMA  BI-214   5.7000E-02  2.4510E-02
20343  12/ 1/81  SHAD                GAMMA  K-40     3.1000E+00  2.7900E-01
20344  12/ 1/81  SILVER HAKE         GAMMA  K-40     3.5000E+00  4.2000E-01
20345  12/ 1/81  HERRING             GAMMA  K-40     4.1000E+00  3.2800E-01
20346  12/ 1/81  COD                 GAMMA  K-40     3.1000E+00  2.7900E-01
20347  11/10/81  CANCER CRABS        GAMMA  K-40     2.1000E+00  3.3600E-01
20348  11/10/81  SILVER HAKE         GAMMA  K-40     4.3000E+00  3.4400E-01
20349  11/10/81  FOURBEARD ROCKLING  GAMMA  K-40     4.2000E+00  8.8200E-01
20350  11/10/81  GREY SOLE           GAMMA  K-40     2.9000E+00  2.6100E-01
20351  11/10/81  FLOUNDER            GAMMA  K-40     3.9000E+00  4.2900E-01
20352  11/10/81  WHITE HAKE          GAMMA  K-40     3.6000E+00  2.5200E-01
20355  11/10/81  GOOSEFISH           GAMMA  K-40     4.4000E+00  3.9600E-01
20357  11/10/81  LOBSTER             GAMMA  K-40     2.5000E+00  2.0000E-01
20358  12/ 1/81  POLLOCK             GAMMA  K-40     4.2000E+00  5.0400E-01
20359  12/ 1/81  WHITE HAKE          GAMMA  K-40     3.3000E+00  2.9700E-01
20361  12/ 1/81  RED HAKE            GAMMA  K-40     3.3000E+00  2.3100E-01
20362  12/ 3/81  MACKEREL            GAMMA  K-40     3.5000E+00  4.2000E-01
20363  12/ 3/81  FLOUNDER            GAMMA  K-40     3.7000E+00  5.1800E-01
20364  12/ 3/81  SILVER HAKE         GAMMA  K-40     3.8000E+00  2.2800E-01
20365  12/ 3/81  COD                 GAMMA  K-40     3.1000E+00  2.4800E-01
20366  12/ 3/81  COD                 GAMMA  K-40     3.5000E+00  2.4500E-01
20367  12/ 3/81  COD                 GAMMA  K-40     4.2000E+00  3.3600E-01
20368  12/ 3/81  COD                 GAMMA  K-40     2.9000E+00  2.3200E-01
20369  12/ 3/81  SILVER HAKE         GAMMA  K-40     1.2000E+01  1.4400E+00
20370  12/ 3/81  CUSK                GAMMA  K-40     2.8000E+00  2.2400E-01
20343  12/ 1/81  SHAD                PB     PB-210  -6.2000E-02  4.1013E-01
20344  12/ 1/81  SILVER HAKE         PB     PB-210   3.2900E-02  2.9036E-01
20345  12/ 1/81  HERRING             PB     PB-210   1.2583E-01  7.1945E-01
20346  12/ 1/81  COD                 PB     PB-210  -1.3300E-02  2.2079E-01
20347  11/10/81  CANCER CRABS        PB     PB-210   9.0100E-02  2.5128E-01
20348  11/10/81  SILVER HAKE         PB     PB-210   1.2290E-01  3.5630E-01
20349  11/10/81  FOURBEARD ROCKLING  PB     PB-210   1.0070E-01  2.9084E-01
20350  11/10/81  GREY SOLE           PB     PB-210  -1.4380E-01  1.9532E-01
20351  11/10/81  FLOUNDER            PB     PB-210   1.6460E-01  3.4278E-01
20352  11/10/81  WHITE HAKE          PB     PB-210   1.0940E-01  2.8105E-01
20355  11/10/81  GOOSEFISH           PB     PB-210   1.2810E-01  1.7784E-01
20357  11/10/81  LOBSTER             PB     PB-210   5.0200E-02  1.9181E-01
20358  12/ 1/81  POLLOCK             PB     PB-210  -2.1300E-02  5.2574E-01
20359  12/ 1/81  WHITE HAKE          PB     PB-210   8.0000E-02  3.3382E-01
20361  12/ 1/81  RED HAKE            PB     PB-210   2.5100E-02  2.0682E-01
20362  12/ 3/81  MACKEREL            PB     PB-210  -6.5800E-02  9.8197E-01
20363  12/ 3/81  FLOUNDER            PB     PB-210   4.3400E-02  2.1947E-01
20364  12/ 3/81  SILVER HAKE         PB     PB-210   2.0610E-01  4.0431E-01
20365  12/ 3/81  COD                 PB     PB-210   1.1230E-02  6.0296E-01
20366  12/ 3/81  COD                 PB     PB-210   1.7390E-01  2.5222E-01
20367  12/ 3/81  COD                 PB     PB-210   4.8150E-01  7.6871E-01
20368  12/ 3/81  COD                 PB     PB-210   8.9990E-02  1.2156E-01
20369  12/ 3/81  SILVER HAKE         PB     PB-210  -1.3500E-02  5.4956E-01
20370  12/ 3/81  CUSK                PB     PB-210   1.2430E-01  3.0656E-01
20365  12/ 3/81  COD                 GAMMA  PB-214   4.5000E-02  2.3400E-02
20343  12/ 1/81  SHAD                PO     PO-210   4.2100E-02  1.4289E-02
20344  12/ 1/81  SILVER HAKE         PO     PO-210   7.0000E-03  6.6444E-03
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20345	12/ 1/81	HERRING	PO	PO-210	5.0244E-03	1.2916E-02
20346	12/ 1/81	COD	PO	PO-210	8.3100E-03	5.8552E-03
20347	11/10/81	CANCER CRABS	PO	PO-210	2.7360E-01	5.7374E-02
20348	11/10/81	SILVER HAKE	PO	PO-210	3.0600E-02	1.1429E-02
20349	11/10/81	FOURBEARD ROCKLING	PO	PO-210	5.1200E-02	1.5575E-02
20350	11/10/81	GREY SOLE	PO	PO-210	1.1900E-02	6.7818E-03
20351	11/10/81	FLOUNDER	PO	PO-210	9.5800E-03	6.7606E-03
20352	11/10/81	WHITE HAKE	PO	PO-210	1.1130E-02	7.1688E-03
20355	11/10/81	GOOSEFISH	PO	PO-210	8.8000E-03	6.5217E-03
20357	11/10/81	LOBSTER	PO	PO-210	1.4100E-02	9.5147E-03
20358	12/ 1/81	POLLOCK	PO	PO-210	-8.4000E-04	2.9942E-03
20359	12/ 1/81	WHITE HAKE	PO	PO-210	2.0800E-02	9.4245E-03
20361	12/ 1/81	RED HAKE	PO	PO-210	2.9400E-02	1.0372E-02
20362	12/ 3/81	MACKEREL	PO	PO-210	1.1920E-02	9.9866E-03
20363	12/ 3/81	FLOUNDER	PO	PO-210	1.9100E-02	9.1833E-03
20364	12/ 3/81	SILVER HAKE	PO	PO-210	6.7000E-03	8.3703E-03
20365	12/ 3/81	COD	PO	PO-210	5.5500E-03	7.1251E-03
20366	12/ 3/81	COD	PO	PO-210	-3.6900E-04	5.7798E-03
20367	12/ 3/81	COD	PO	PO-210	1.0190E-03	6.2831E-03
20368	12/ 3/81	COD	PO	PO-210	6.0490E-01	1.6732E-01
20369	12/ 3/81	SILVER HAKE	PO	PO-210	1.8800E-02	1.2733E-02
20370	12/ 3/81	CUSK	PO	PO-210	-1.3100E-03	3.2307E-03
20343	12/ 1/81	SHAD	RA	RA-226	2.0000E-03	3.2000E-04
20344	12/ 1/81	SILVER HAKE	RA	RA-226	2.0000E-03	3.2000E-04
20346	12/ 1/81	COD	RA	RA-226	2.0000E-03	2.8000E-04
20352	11/10/81	WHITE HAKE	RA	RA-226	2.0000E-03	3.4000E-04
20355	11/10/81	GOOSEFISH	RA	RA-226	2.0000E-03	2.6000E-04
20358	12/ 1/81	POLLOCK	RA	RA-226	2.0000E-03	3.0000E-04
20359	12/ 1/81	WHITE HAKE	RA	RA-226	3.0000E-03	3.6000E-04
20361	12/ 1/81	RED HAKE	RA	RA-226	3.0000E-03	3.6000E-04
20362	12/ 3/81	MACKEREL	RA	RA-226	2.0000E-03	2.6000E-04
20366	12/ 3/81	COD	RA	RA-226	2.0000E-03	4.2000E-04
20367	12/ 3/81	COD	RA	RA-226	2.0000E-03	2.6000E-04
20368	12/ 3/81	COD	RA	RA-226	2.0000E-03	2.8000E-04
20343	12/ 1/81	SHAD	TH	TH-227	-2.1020E-04	2.9740E-04
20344	12/ 1/81	SILVER HAKE	TH	TH-227	0.0000E-01	1.5830E-04
20346	12/ 1/81	COD	TH	TH-227	0.0000E-01	1.7150E-04
20352	11/10/81	WHITE HAKE	TH	TH-227	2.1150E-04	2.5390E-04
20355	11/10/81	GOOSEFISH	TH	TH-227	0.0000E-01	0.0000E-01
20358	12/ 1/81	POLLOCK	TH	TH-227	5.1200E-05	2.7090E-04
20359	12/ 1/81	WHITE HAKE	TH	TH-227	1.8470E-04	1.8490E-04
20361	12/ 1/81	RED HAKE	TH	TH-227	5.1320E-05	1.0280E-04
20362	12/ 3/81	MACKEREL	TH	TH-227	0.0000E-01	1.9580E-04
20366	12/ 3/81	COD	TH	TH-227	-1.0710E-04	2.1450E-04
20367	12/ 3/81	COD	TH	TH-227	2.4070E-04	2.1760E-04
20368	12/ 3/81	COD	TH	TH-227	2.3600E-04	2.3760E-04
20343	12/ 1/81	SHAD	TH	TH-228	-6.1670E-04	4.9520E-04
20344	12/ 1/81	SILVER HAKE	TH	TH-228	-3.9680E-04	3.4490E-04
20346	12/ 1/81	COD	TH	TH-228	-4.6000E-04	2.9710E-04
20352	11/10/81	WHITE HAKE	TH	TH-228	-3.0800E-04	3.1920E-04
20355	11/10/81	GOOSEFISH	TH	TH-228	-2.5530E-04	2.9930E-04
20358	12/ 1/81	POLLOCK	TH	TH-228	-3.9430E-04	3.3450E-04
20359	12/ 1/81	WHITE HAKE	TH	TH-228	-5.0070E-04	3.7700E-04
20361	12/ 1/81	RED HAKE	TH	TH-228	-1.4580E-03	3.6360E-04
20362	12/ 3/81	MACKEREL	TH	TH-228	-1.4240E-03	4.2540E-04

20366	12/ 3/81	COD	TH	TH-228	-1.5580E-03	3.8810E-04
20367	12/ 3/81	COD	TH	TH-228	-2.5230E-04	4.9510E-04
20368	12/ 3/81	COD	TH	TH-228	-1.3900E-03	3.5760E-04
20343	12/ 1/81	SHAD	TH	TH-230	0.0000E-01	2.0180E-04
20344	12/ 1/81	SILVER HAKE	TH	TH-230	1.3430E-04	1.6120E-04
20346	12/ 1/81	COD	TH	TH-230	1.2350E-04	1.8410E-04
20352	11/10/81	WHITE HAKE	TH	TH-230	2.0300E-05	1.7700E-04
20355	11/10/81	GOOSEFISH	TH	TH-230	4.4670E-05	1.0940E-04
20358	12/ 1/81	POLLOCK	TH	TH-230	2.2120E-04	1.4760E-04
20359	12/ 1/81	WHITE HAKE	TH	TH-230	1.1080E-04	1.3310E-04
20361	12/ 1/81	RED HAKE	TH	TH-230	4.4340E-04	2.4640E-04
20362	12/ 3/81	MACKEREL	TH	TH-230	4.3200E-04	2.6200E-04
20366	12/ 3/81	COD	TH	TH-230	1.7990E-04	2.2500E-04
20367	12/ 3/81	COD	TH	TH-230	3.2350E-04	2.0060E-04
20368	12/ 3/81	COD	TH	TH-230	2.2650E-04	2.1350E-04
20343	12/ 1/81	SHAD	TH	TH-232	-5.0450E-05	1.0090E-04
20344	12/ 1/81	SILVER HAKE	TH	TH-232	1.6120E-04	1.3170E-04
20346	12/ 1/81	COD	TH	TH-232	1.6460E-04	1.1650E-04
20352	11/10/81	WHITE HAKE	TH	TH-232	1.2180E-04	1.1490E-04
20355	11/10/81	GOOSEFISH	TH	TH-232	2.2340E-05	4.4680E-05
20358	12/ 1/81	POLLOCK	TH	TH-232	4.9150E-05	6.9530E-05
20359	12/ 1/81	WHITE HAKE	TH	TH-232	1.1080E-04	1.3310E-04
20361	12/ 1/81	RED HAKE	TH	TH-232	9.8540E-05	1.2120E-04
20362	12/ 3/81	MACKEREL	TH	TH-232	3.3230E-04	2.1350E-04
20366	12/ 3/81	COD	TH	TH-232	2.5700E-05	1.5420E-04
20367	12/ 3/81	COD	TH	TH-232	1.1550E-04	1.0440E-04
20368	12/ 3/81	COD	TH	TH-232	5.6630E-05	1.1350E-04
20343	12/ 1/81	SHAD	U	U-234	9.3530E-04	3.0540E-04
20344	12/ 1/81	SILVER HAKE	U	U-234	1.9260E-03	5.8940E-04
20346	12/ 1/81	COD	U	U-234	2.7780E-04	2.1050E-04
20352	11/10/81	WHITE HAKE	U	U-234	8.2990E-04	2.9500E-04
20355	11/10/81	GOOSEFISH	U	U-234	3.4630E-05	2.0910E-05
20358	12/ 1/81	POLLOCK	U	U-234	7.5900E-04	3.4970E-04
20359	12/ 1/81	WHITE HAKE	U	U-234	9.4400E-04	3.2980E-04
20361	12/ 1/81	RED HAKE	U	U-234	6.3990E-04	2.8020E-04
20362	12/ 3/81	MACKEREL	U	U-234	7.8890E-04	2.8970E-04
20366	12/ 3/81	COD	U	U-234	6.3750E-04	2.5420E-04
20367	12/ 3/81	COD	U	U-234	5.1660E-04	2.4570E-04
20368	12/ 3/81	COD	U	U-234	4.5060E-04	2.0390E-04
20343	12/ 1/81	SHAD	U	U-235	7.9600E-05	1.1310E-04
20344	12/ 1/81	SILVER HAKE	U	U-235	2.4080E-04	1.9360E-04
20346	12/ 1/81	COD	U	U-235	-4.6300E-05	1.3110E-04
20352	11/10/81	WHITE HAKE	U	U-235	2.2430E-04	1.5830E-04
20355	11/10/81	GOOSEFISH	U	U-235	6.4940E-06	7.5560E-06
20358	12/ 1/81	POLLOCK	U	U-235	2.8110E-05	1.2580E-04
20359	12/ 1/81	WHITE HAKE	U	U-235	2.2480E-05	1.3490E-04
20361	12/ 1/81	RED HAKE	U	U-235	-5.5640E-05	1.1150E-04
20362	12/ 3/81	MACKEREL	U	U-235	4.6410E-05	9.3010E-05
20366	12/ 3/81	COD	U	U-235	4.5530E-05	6.4650E-05
20367	12/ 3/81	COD	U	U-235	-2.4600E-05	1.1010E-04
20368	12/ 3/81	COD	U	U-235	0.0000E-01	5.5410E-05
20343	12/ 1/81	SHAD	U	U-238	5.5720E-04	2.4370E-04
20344	12/ 1/81	SILVER HAKE	U	U-238	4.2130E-04	2.3350E-04
20346	12/ 1/81	COD	U	U-238	2.3150E-04	1.7610E-04
20352	11/10/81	WHITE HAKE	U	U-238	4.4860E-04	2.0960E-04

20355	11/10/81	GOOSEFISH	U	U-238	2.8140E-05	1.7250E-05
20358	12/ 1/81	POLLOCK	U	U-238	6.1850E-04	2.9980E-04
20359	12/ 1/81	WHITE HAKE	U	U-238	2.6970E-04	1.8340E-04
20361	12/ 1/81	RED HAKE	U	U-238	3.8950E-04	2.1460E-04
20362	12/ 3/81	MACKEREL	U	U-238	4.6410E-04	2.2600E-04
20366	12/ 3/81	COD	U	U-238	3.6430E-04	1.8790E-04
20367	12/ 3/81	COD	U	U-238	2.4600E-04	1.7350E-04
20368	12/ 3/81	COD	U	U-238	3.7220E-04	1.7710E-04

Radionuclide Analyses of Nonedible Biota Samples
1981 NOAA Sampling for EPA

Sample Number	Date Collected	Sample Type	Analysis	Nuclide	Activity pCi/g (wet)	2-Sigma Error
		MAN-MADE NUCLIDES				
15440	7/21/81	INFAUNA	GAMMA	CS-137	1.2000E-01	9.3600E-02
15442	7/21/81	INFAUNA	GAMMA	CS-137	4.1000E-02	1.1070E-02
14474	7/26/81	STARFISH	PU	PU-238	1.5780E-03	1.1380E-02
15440	7/21/81	INFAUNA	PU	PU-238	4.8000E-03	7.6320E-03
15444	7/21/81	INFAUNA	PU	PU-238	1.3300E-02	1.1571E-02
15445	7/21/81	INFAUNA	PU	PU-238	1.8000E-02	1.6920E-02
20356	11/10/81	SKATES	PU	PU-238	3.9240E-04	2.9350E-04
14474	7/26/81	STARFISH	PU	PU-239	9.4680E-03	8.9820E-03
15440	7/21/81	INFAUNA	PU	PU-239	2.4000E-03	1.0176E-02
15444	7/21/81	INFAUNA	PU	PU-239	-6.7000E-03	1.4204E-02
15445	7/21/81	INFAUNA	PU	PU-239	1.6000E-02	2.3840E-02
20356	11/10/81	SKATES	PU	PU-239	4.3600E-05	1.5110E-04
14474	7/26/81	STARFISH	SR	SR-90	-3.6000E-02	2.5200E-02
15440	7/21/81	INFAUNA	SR	SR-90	-7.0000E-04	1.7500E-03
15444	7/21/81	INFAUNA	SR	SR-90	9.9000E-03	1.3167E-02
15445	7/21/81	INFAUNA	SR	SR-90	8.0000E-03	3.6000E-02
20356	11/10/81	SKATES	SR	SR-90	3.0000E-04	4.5000E-04
		NATURAL NUCLIDES				
15440	7/21/81	INFAUNA	GAMMA	BI-214	6.5000E-01	3.3150E-01
15440X	7/21/81	INFAUNA	GAMMA	BI-214	7.5000E-01	3.0750E-01
15442	7/21/81	INFAUNA	GAMMA	BI-214	5.5000E-01	3.8500E-02
15444	7/21/81	INFAUNA	GAMMA	BI-214	2.3000E-01	1.4720E-01
15445	7/21/81	INFAUNA	GAMMA	BI-214	3.0000E-01	1.2600E-01
15440	7/21/81	INFAUNA	GAMMA	K-40	2.1000E+01	3.3600E+00
15440X	7/21/81	INFAUNA	GAMMA	K-40	2.0000E+01	3.4000E+00
15442	7/21/81	INFAUNA	GAMMA	K-40	1.9000E+01	3.8000E-01
15444	7/21/81	INFAUNA	GAMMA	K-40	1.4000E+01	1.2600E+00
15445	7/21/81	INFAUNA	GAMMA	K-40	1.0000E+01	1.0000E+00
20353	11/10/81	RED CRAB	GAMMA	K-40	2.0000E+00	2.8000E-01
20354	11/10/81	STARFISH	GAMMA	K-40	2.1000E+00	1.8900E-01
20356	11/10/81	SKATES	GAMMA	K-40	2.1000E+00	2.1000E-01
20360	12/ 1/81	STARFISH	GAMMA	K-40	2.8000E+00	7.2800E-01
14474	7/26/81	STARFISH	PB	PB-210	2.7800E-01	5.0827E-01
15440	7/21/81	INFAUNA	PB	PB-210	5.9000E-01	3.9719E-01
15440X	7/21/81	INFAUNA	PB	PB-210	1.4750E+00	5.0091E-01
15444	7/21/81	INFAUNA	PB	PB-210	4.8200E-01	5.1791E-01
15445	7/21/81	INFAUNA	PB	PB-210	1.7880E+00	1.2257E+00
20353	11/10/81	RED CRAB	PB	PB-210	1.9980E-02	5.1059E+00
20354	11/10/81	STARFISH	PB	PB-210	3.8360E-01	4.0109E-01
20356	11/10/81	SKATES	PB	PB-210	9.6600E-02	3.4110E-01
20360	12/ 1/81	STARFISH	PB	PB-210	2.6800E-02	2.1300E-01
15440	7/21/81	INFAUNA	GAMMA	PB-214	8.3000E-01	2.4900E-01
15440X	7/21/81	INFAUNA	GAMMA	PB-214	7.2000E-01	3.0240E-01
15442	7/21/81	INFAUNA	GAMMA	PB-214	6.1000E-01	3.6600E-02

15444	7/21/81	INFAUNA	GAMMA	PB-214	3.3000E-01	1.3860E-01
15445	7/21/81	INFAUNA	GAMMA	PB-214	3.5000E-01	1.2950E-01
15440	7/21/81	INFAUNA	PO	PO-210	2.9900E-01	3.2890E-02
15440X	7/21/81	INFAUNA	PO	PO-210	5.1500E-01	9.1206E-02
15444	7/21/81	INFAUNA	PO	PO-210	5.1300E-01	1.0614E-01
15445	7/21/81	INFAUNA	PO	PO-210	6.7770E-01	1.3208E-01
20353	11/10/81	RED CRAB	PO	PO-210	6.5830E-01	1.9051E-01
20354	11/10/81	STARFISH	PO	PO-210	1.3130E-01	3.2352E-02
20356	11/10/81	SKATES	PO	PO-210	3.8000E-03	4.0782E-03
20360	12/ 1/81	STARFISH	PO	PO-210	7.8600E-02	1.8243E-02
14474	7/26/81	STARFISH	RA	RA-226	3.9000E-01	1.9500E-02
15440	7/21/81	INFAUNA	RA	RA-226	2.0000E-01	1.0000E-02
15444	7/21/81	INFAUNA	RA	RA-226	2.4750E-01	1.4850E-02
15445	7/21/81	INFAUNA	RA	RA-226	3.2900E-01	1.9740E-02
20356	11/10/81	SKATES	RA	RA-226	3.0000E-03	4.5000E-04
14474	7/26/81	STARFISH	TH	TH-227	3.5730E-02	1.5080E-02
15440	7/21/81	INFAUNA	TH	TH-227	1.7800E-02	8.1880E-03
15444	7/21/81	INFAUNA	TH	TH-227	8.3000E-03	9.6280E-03
15445	7/21/81	INFAUNA	TH	TH-227	2.4000E-02	1.4640E-02
20356	11/10/81	SKATES	TH	TH-227	4.5220E-04	3.4220E-04
14474	7/26/81	STARFISH	TH	TH-228	2.2430E-01	3.0710E-02
15440	7/21/81	INFAUNA	TH	TH-228	3.0100E-01	2.4080E-02
15444	7/21/81	INFAUNA	TH	TH-228	2.5400E-01	3.0480E-02
15445	7/21/81	INFAUNA	TH	TH-228	4.0000E-01	4.4000E-02
20356	11/10/81	SKATES	TH	TH-228	-6.4730E-04	3.8920E-04
14474	7/26/81	STARFISH	TH	TH-230	6.2000E-02	1.3540E-02
15440	7/21/81	INFAUNA	TH	TH-230	1.7200E-01	1.5480E-02
15444	7/21/81	INFAUNA	TH	TH-230	2.0400E-01	2.4480E-02
15445	7/21/81	INFAUNA	TH	TH-230	3.0900E-01	3.3990E-02
20356	11/10/81	SKATES	TH	TH-230	2.4810E-04	1.7560E-04
15440	7/21/81	INFAUNA	GAMMA	TH-232	2.6000E+00	6.2400E-01
15440X	7/21/81	INFAUNA	GAMMA	TH-232	2.5000E+00	6.5000E-01
15442	7/21/81	INFAUNA	GAMMA	TH-232	7.0000E-01	5.6000E-02
15444	7/21/81	INFAUNA	GAMMA	TH-232	7.6000E-01	2.0520E-01
15445	7/21/81	INFAUNA	GAMMA	TH-232	6.6000E-01	2.8380E-01
14474	7/26/81	STARFISH	TH	TH-232	6.3320E-02	1.3420E-02
15440	7/21/81	INFAUNA	TH	TH-232	1.8100E-01	1.6290E-02
15444	7/21/81	INFAUNA	TH	TH-232	2.3800E-01	2.6180E-02
15445	7/21/81	INFAUNA	TH	TH-232	3.6600E-01	3.6600E-02
20356	11/10/81	SKATES	TH	TH-232	2.1710E-04	1.6430E-04
14474	7/26/81	STARFISH	U	U-234	1.8850E-01	3.1740E-02
15440	7/21/81	INFAUNA	U	U-234	1.7900E-01	2.3270E-02
15444	7/21/81	INFAUNA	U	U-234	2.3900E-01	3.8240E-02
15445	7/21/81	INFAUNA	U	U-234	4.6600E-01	6.0580E-02
20356	11/10/81	SKATES	U	U-234	1.8460E-03	5.7480E-04
14474	7/26/81	STARFISH	U	U-235	2.7320E-03	4.8250E-03
15440	7/21/81	INFAUNA	U	U-235	1.5000E-02	5.7000E-03
15444	7/21/81	INFAUNA	U	U-235	1.6000E-02	8.3200E-03
15445	7/21/81	INFAUNA	U	U-235	3.4000E-02	1.3260E-02
20356	11/10/81	SKATES	U	U-235	2.8960E-04	2.3230E-04
14474	7/26/81	STARFISH	U	U-238	1.7210E-01	2.9750E-02
15440	7/21/81	INFAUNA	U	U-238	1.4800E-01	2.0720E-02
15444	7/21/81	INFAUNA	U	U-238	2.0900E-01	3.5530E-02
15445	7/21/81	INFAUNA	U	U-238	4.1300E-01	5.3690E-02
20356	11/10/81	SKATES	U	U-238	8.6880E-04	3.7380E-04

GROSS ALPHA

14474	7/26/81	STARFISH	ALPHA	ALPHA	3.7400E+00	2.0570E+00
15440	7/21/81	INFAUNA	ALPHA	ALPHA	2.4670E+00	1.3075E+00
15444	7/21/81	INFAUNA	ALPHA	ALPHA	7.4000E-01	1.2802E+00
15445	7/21/81	INFAUNA	ALPHA	ALPHA	3.3500E+00	2.2110E+00

GROSS BETA

14474	7/26/81	STARFISH	BETA	BETA	-2.5600E+00	1.1520E+00
15440	7/21/81	INFAUNA	BETA	BETA	4.4204E+00	8.3988E-01
15444	7/21/81	INFAUNA	BETA	BETA	1.1470E+00	1.2617E+00
15445	7/21/81	INFAUNA	BETA	BETA	6.3500E+00	1.5875E+00

Radionuclide Analyses of Sediment Samples
1981 NOAA Sampling for EPA

Sample Number	Date Collected	Analysis	Nuclide	Activity pCi/g (dry)	2-Sigma Error
	MAN-MADE NUCLIDES				
15429	7/21/81	GAMMA	CS-137	1.7800E-01	3.9160E-02
15430	7/21/81	GAMMA	CS-137	1.3000E-01	5.8500E-02
15430X	7/21/81	GAMMA	CS-137	1.2000E-01	7.8000E-02
15431	7/21/81	GAMMA	CS-137	1.5300E-01	2.9070E-02
15432	7/21/81	GAMMA	CS-137	3.7000E-02	3.1450E-02
15436	7/21/81	GAMMA	CS-137	1.4000E-02	8.2600E-03
15437	7/21/81	GAMMA	CS-137	6.9000E-02	5.7270E-02
15439	7/21/81	GAMMA	CS-137	3.6200E-01	5.0680E-02
15441	7/21/81	GAMMA	CS-137	1.7470E-01	2.9699E-02
15443	7/21/81	GAMMA	CS-137	6.3000E-02	2.5830E-02
15446	7/21/81	GAMMA	CS-137	4.5000E-02	2.6100E-02
23940	7/ 7/82	GAMMA	CS-137	8.9000E-02	1.7800E-02
23943	7/ 7/82	GAMMA	CS-137	7.6000E-02	2.0520E-02
23944	7/ 7/82	GAMMA	CS-137	1.0200E-01	2.2440E-02
23945	7/ 7/82	GAMMA	CS-137	4.3000E-02	1.2900E-02
23946	7/ 7/82	GAMMA	CS-137	1.6000E-02	1.5520E-02
23947	7/ 7/82	GAMMA	CS-137	1.4000E-01	2.5200E-02
23948	7/ 7/82	GAMMA	CS-137	1.1000E-01	2.0900E-02
23950	7/ 7/82	GAMMA	CS-137	1.4000E-01	2.5200E-02
23950X	7/ 7/82	GAMMA	CS-137	1.3000E-01	2.4700E-02
23951	7/ 7/82	GAMMA	CS-137	1.3000E-01	2.8600E-02
23952	7/ 7/82	GAMMA	CS-137	1.1000E-01	2.2000E-02
15429	7/21/81	PU	PU-238	6.6550E-02	4.9250E-02
15431	7/21/81	PU	PU-238	3.6000E-02	3.6000E-02
15433	7/21/81	PU	PU-238	2.9600E-02	2.5456E-02
15436	7/21/81	PU	PU-238	6.5000E-02	4.0950E-02
15437	7/21/81	PU	PU-238	7.4000E-02	3.7740E-02
15439	7/21/81	PU	PU-238	6.9650E-02	3.2780E-02
15441	7/21/81	PU	PU-238	2.3000E-02	3.6110E-02
15443	7/21/81	PU	PU-238	2.8670E-02	2.4480E-02
15446	7/21/81	PU	PU-238	5.1160E-02	2.8580E-02
15447	7/21/81	PU	PU-238	4.3000E-02	2.8810E-02
23940X	7/ 7/82	PU	PU-238	1.1760E-02	2.8860E-02
23941	7/ 7/82	PU	PU-238	5.6860E-02	2.9570E-02
23942	7/ 7/82	PU	PU-238	8.2660E-03	1.0130E-02
23943	7/ 7/82	PU	PU-238	8.3520E-03	1.1760E-02
23944	7/ 7/82	PU	PU-238	1.5150E-02	1.9920E-02
23945	7/ 7/82	PU	PU-238	1.6050E-02	2.5170E-02
23946	7/ 7/82	PU	PU-238	0.0000E-01	1.8950E-02
23947	7/ 7/82	PU	PU-238	2.3210E-03	1.0440E-02
23948	7/ 7/82	PU	PU-238	6.5650E-03	9.6090E-03
23949	7/ 7/82	PU	PU-238	7.2970E-03	1.7890E-02
23950X	7/ 7/82	PU	PU-238	2.2310E-02	1.5280E-02
23951	7/ 7/82	PU	PU-238	6.3690E-03	1.2180E-02
23952	7/ 7/82	PU	PU-238	1.1200E-02	8.9150E-03
15429	7/21/81	PU	PU-239	1.9010E-02	2.3420E-02

15431	7/21/81	PU	PU-239	3.1000E-02	2.3560E-02
15433	7/21/81	PU	PU-239	0.0000E-01	0.0000E-01
15436	7/21/81	PU	PU-239	1.1000E-02	2.2000E-02
15437	7/21/81	PU	PU-239	1.9000E-02	2.0140E-02
15439	7/21/81	PU	PU-239	-1.1000E-02	1.6430E-02
15441	7/21/81	PU	PU-239	3.9000E-02	2.9250E-02
15443	7/21/81	PU	PU-239	1.4330E-02	2.2250E-02
15446	7/21/81	PU	PU-239	1.3640E-02	3.3450E-02
15447	7/21/81	PU	PU-239	-3.6000E-03	1.2492E-02
23940X	7/ 7/82	PU	PU-239	5.5880E-02	2.6710E-02
23941	7/ 7/82	PU	PU-239	3.5540E-03	7.1260E-03
23942	7/ 7/82	PU	PU-239	1.0310E-02	9.2870E-03
23943	7/ 7/82	PU	PU-239	6.3310E-02	2.3150E-02
23944	7/ 7/82	PU	PU-239	6.2750E-02	2.4590E-02
23945	7/ 7/82	PU	PU-239	4.0110E-02	2.8280E-02
23946	7/ 7/82	PU	PU-239	2.1190E-03	7.3450E-03
23947	7/ 7/82	PU	PU-239	6.3730E-02	2.3670E-02
23948	7/ 7/82	PU	PU-239	5.5370E-02	2.0480E-02
23949	7/ 7/82	PU	PU-239	1.2770E-02	9.7650E-03
23950X	7/ 7/82	PU	PU-239	6.0370E-02	2.2170E-02
23951	7/ 7/82	PU	PU-239	3.1220E-02	1.4690E-02
23952	7/ 7/82	PU	PU-239	3.9830E-02	1.7950E-02
15429	7/21/81	SR	SR-90	0.0000E-01	0.0000E-01
15431	7/21/81	SR	SR-90	1.9000E-02	2.8500E-03
15433	7/21/81	SR	SR-90	2.9800E-02	7.9566E-02
15436	7/21/81	SR	SR-90	8.9000E-02	2.1716E-01
15437	7/21/81	SR	SR-90	9.7000E-03	1.9400E-02
15439	7/21/81	SR	SR-90	4.5000E-02	1.8900E-01
15441	7/21/81	SR	SR-90	9.5000E-03	2.8500E-02
15443	7/21/81	SR	SR-90	5.8000E-02	2.4186E-01
15446	7/21/81	SR	SR-90	6.8000E-02	1.2648E-01
15447	7/21/81	SR	SR-90	7.0000E-02	1.4980E-01
23940	7/ 7/82	SR	SR-90	7.2000E-02	1.3536E-01
23940X	7/ 7/82	SR	SR-90	1.4400E-01	1.3536E-01
23941	7/ 7/82	SR	SR-90	1.4300E-01	1.3299E-01
23942	7/ 7/82	SR	SR-90	-8.0000E-02	1.4000E-01
23943	7/ 7/82	SR	SR-90	-9.0000E-02	1.4400E-01
23944	7/ 7/82	SR	SR-90	6.0000E-02	1.2000E-01
23945	7/ 7/82	SR	SR-90	7.0000E-02	1.0500E-01
23946	7/ 7/82	SR	SR-90	2.0000E-02	1.4000E-01
23947	7/ 7/82	SR	SR-90	4.0000E-02	1.3000E-01
23948	7/ 7/82	SR	SR-90	3.0000E-02	1.2990E-01
23949	7/ 7/82	SR	SR-90	-8.0000E-02	1.1520E-01
23950	7/ 7/82	SR	SR-90	3.0000E-02	1.2000E-01
23950X	7/ 7/82	SR	SR-90	5.0000E-02	1.0000E-01
23951	7/ 7/82	SR	SR-90	-1.0000E-01	1.2700E-01
23952	7/ 7/82	SR	SR-90	1.2000E-01	1.2000E-01

NATURAL NUCLIDES

15429	7/21/81	GAMMA	BI-214	1.9300E+00	9.6500E-02
15430	7/21/81	GAMMA	BI-214	1.0000E+00	1.8000E-01
15430X	7/21/81	GAMMA	BI-214	9.2000E-01	1.7480E-01
15431	7/21/81	GAMMA	BI-214	1.4120E+00	7.0600E-02
15432	7/21/81	GAMMA	BI-214	5.8000E-01	1.1020E-01

15433	7/21/81	GAMMA	BI-214	1.8400E-01	2.3920E-02
15434	7/21/81	GAMMA	BI-214	1.4000E-01	6.4400E-02
15435	7/21/81	GAMMA	BI-214	1.0000E-01	2.1000E-02
15436	7/21/81	GAMMA	BI-214	4.8600E-01	3.4020E-02
15437	7/21/81	GAMMA	BI-214	1.2420E+00	8.6940E-02
15438	7/21/81	GAMMA	BI-214	2.6000E-01	1.0400E-01
15439	7/21/81	GAMMA	BI-214	2.4200E-01	1.4520E-02
15441	7/21/81	GAMMA	BI-214	9.6650E-01	7.7320E-02
15443	7/21/81	GAMMA	BI-214	1.4500E+00	8.7000E-02
15446	7/21/81	GAMMA	BI-214	8.6400E-01	5.1840E-02
15447	7/21/81	GAMMA	BI-214	2.0800E-01	2.4960E-02
23940	7/ 7/82	GAMMA	BI-214	6.8500E-01	4.7950E-02
23941	7/ 7/82	GAMMA	BI-214	8.5000E-01	4.2500E-02
23942	7/ 7/82	GAMMA	BI-214	7.4000E-01	3.7000E-02
23943	7/ 7/82	GAMMA	BI-214	4.1800E-01	5.4340E-02
23944	7/ 7/82	GAMMA	BI-214	6.1500E-01	6.7650E-02
23945	7/ 7/82	GAMMA	BI-214	3.2800E-01	3.6080E-02
23946	7/ 7/82	GAMMA	BI-214	5.0000E-01	4.5000E-02
23947	7/ 7/82	GAMMA	BI-214	6.9000E-01	6.9000E-02
23948	7/ 7/82	GAMMA	BI-214	6.3000E-01	5.6700E-02
23949	7/ 7/82	GAMMA	BI-214	4.7000E-01	4.7000E-02
23950	7/ 7/82	GAMMA	BI-214	6.8000E-01	6.8000E-02
23950X	7/ 7/82	GAMMA	BI-214	7.3000E-01	6.5700E-02
23951	7/ 7/82	GAMMA	BI-214	6.9000E-01	7.5900E-02
23952	7/ 7/82	GAMMA	BI-214	6.8000E-01	6.8000E-02
15429	7/21/81	GAMMA	K-40	3.9130E+01	1.1739E+00
15430	7/21/81	GAMMA	K-40	1.8000E+01	1.9800E+00
15430X	7/21/81	GAMMA	K-40	1.7000E+01	2.0400E+00
15431	7/21/81	GAMMA	K-40	3.2442E+01	9.7326E-01
15432	7/21/81	GAMMA	K-40	2.3000E+01	9.2000E-01
15433	7/21/81	GAMMA	K-40	5.7670E+00	2.8835E-01
15434	7/21/81	GAMMA	K-40	8.8000E+00	7.0400E-01
15435	7/21/81	GAMMA	K-40	1.7000E+00	1.3600E-01
15436	7/21/81	GAMMA	K-40	8.0000E+00	2.4000E-01
15437	7/21/81	GAMMA	K-40	2.4510E+01	9.8040E-01
15438	7/21/81	GAMMA	K-40	1.8000E+01	1.0800E+00
15439	7/21/81	GAMMA	K-40	6.6900E+01	1.3380E+00
15441	7/21/81	GAMMA	K-40	3.5316E+01	1.0595E+00
15443	7/21/81	GAMMA	K-40	2.9670E+01	8.9010E-01
15446	7/21/81	GAMMA	K-40	1.8260E+01	5.4780E-01
15447	7/21/81	GAMMA	K-40	3.1250E+00	1.8750E-01
23940	7/ 7/82	GAMMA	K-40	1.7140E+01	5.1420E-01
23941	7/ 7/82	GAMMA	K-40	2.8890E+01	5.7780E-01
23942	7/ 7/82	GAMMA	K-40	2.1970E+01	4.3940E-01
23943	7/ 7/82	GAMMA	K-40	1.8670E+01	5.6010E-01
23944	7/ 7/82	GAMMA	K-40	1.8680E+01	7.4720E-01
23945	7/ 7/82	GAMMA	K-40	1.2410E+01	3.7230E-01
23946	7/ 7/82	GAMMA	K-40	1.5600E+01	4.6800E-01
23947	7/ 7/82	GAMMA	K-40	1.9490E+01	7.7960E-01
23948	7/ 7/82	GAMMA	K-40	1.7390E+01	6.9560E-01
23949	7/ 7/82	GAMMA	K-40	1.6080E+01	1.6080E-01
23950	7/ 7/82	GAMMA	K-40	2.0490E+01	4.0980E-01
23950X	7/ 7/82	GAMMA	K-40	2.0490E+01	8.1960E-01
23951	7/ 7/82	GAMMA	K-40	2.0830E+01	8.3320E-01
23952	7/ 7/82	GAMMA	K-40	1.8780E+01	7.5120E-01

15429	7/21/81	PB	PB-210	4.3890E+00	1.8140E+00
15430	7/21/81	PB	PB-210	1.4060E+00	8.4613E-01
15430X	7/21/81	PB	PB-210	1.3150E+00	6.0464E-01
15431	7/21/81	PB	PB-210	2.3440E+00	1.5590E+00
15432	7/21/81	PB	PB-210	4.1280E+00	1.8176E+00
15433	7/21/81	PB	PB-210	9.6120E-01	1.4550E+00
15434	7/21/81	PB	PB-210	1.9500E+00	1.9186E+00
15435	7/21/81	PB	PB-210	9.8700E-01	1.1716E+00
15436	7/21/81	PB	PB-210	1.7190E+00	1.6250E+00
15437	7/21/81	PB	PB-210	2.1300E+00	1.8280E+00
15438	7/21/81	PB	PB-210	2.4400E+00	1.0463E+00
15439	7/21/81	PB	PB-210	5.3560E+00	2.6310E+00
15441	7/21/81	PB	PB-210	8.0130E+00	3.1660E+00
15443	7/21/81	PB	PB-210	6.4440E+00	3.3910E+00
15446	7/21/81	PB	PB-210	4.4030E+00	2.3380E+00
15447	7/21/81	PB	PB-210	2.0250E+00	2.3970E+00
23940	7/ 7/82	PB	PB-210	2.9807E+00	9.7232E-01
23940X	7/ 7/82	PB	PB-210	4.7812E+00	1.4739E+00
23941	7/ 7/82	PB	PB-210	3.4530E+00	1.3114E+00
23942	7/ 7/82	PB	PB-210	3.8789E+00	1.5514E+00
23943	7/ 7/82	PB	PB-210	5.4087E+00	1.5739E+00
23944	7/ 7/82	PB	PB-210	2.5373E+00	1.6848E+00
23945	7/ 7/82	PB	PB-210	3.1765E+00	9.8915E-01
23946	7/ 7/82	PB	PB-210	2.4858E+00	1.1826E+00
23947	7/ 7/82	PB	PB-210	1.9985E+00	1.5298E+00
23948	7/ 7/82	PB	PB-210	3.6509E+00	9.4950E-01
23949	7/ 7/82	PB	PB-210	9.4914E-01	1.0500E+00
23950X	7/ 7/82	PB	PB-210	3.5117E+00	9.1051E-01
23951	7/ 7/82	PB	PB-210	3.7459E+00	1.0984E+00
23952	7/ 7/82	PB	PB-210	2.3943E+00	8.4093E-01
15429	7/21/81	GAMMA	PB-214	2.0000E+00	1.0000E-01
15430	7/21/81	GAMMA	PB-214	9.0000E-01	1.6200E-01
15430X	7/21/81	GAMMA	PB-214	9.0000E-01	1.7100E-01
15431	7/21/81	GAMMA	PB-214	1.4690E+00	7.3450E-02
15432	7/21/81	GAMMA	PB-214	6.2000E-01	8.6800E-02
15433	7/21/81	GAMMA	PB-214	1.8400E-01	1.8400E-02
15434	7/21/81	GAMMA	PB-214	2.0000E-01	6.4000E-02
15435	7/21/81	GAMMA	PB-214	1.2000E-01	2.0400E-02
15436	7/21/81	GAMMA	PB-214	4.9900E-01	2.9940E-02
15437	7/21/81	GAMMA	PB-214	1.3240E+00	7.9440E-02
15438	7/21/81	GAMMA	PB-214	4.0000E-01	9.6000E-02
15439	7/21/81	GAMMA	PB-214	2.5100E-01	1.2550E-02
15441	7/21/81	GAMMA	PB-214	1.0780E+00	6.4680E-02
15443	7/21/81	GAMMA	PB-214	1.4300E+00	5.7200E-02
15446	7/21/81	GAMMA	PB-214	9.6300E-01	4.8150E-02
15447	7/21/81	GAMMA	PB-214	2.0800E-01	2.2880E-02
23940	7/ 7/82	GAMMA	PB-214	8.0600E-01	4.8360E-02
23941	7/ 7/82	GAMMA	PB-214	9.3000E-01	3.7200E-02
23942	7/ 7/82	GAMMA	PB-214	7.5000E-01	3.7500E-02
23943	7/ 7/82	GAMMA	PB-214	5.1600E-01	5.1600E-02
23944	7/ 7/82	GAMMA	PB-214	6.8600E-01	4.8020E-02
23945	7/ 7/82	GAMMA	PB-214	4.1400E-01	3.7260E-02
23946	7/ 7/82	GAMMA	PB-214	6.0000E-01	4.8000E-02
23947	7/ 7/82	GAMMA	PB-214	7.2000E-01	5.0400E-02
23948	7/ 7/82	GAMMA	PB-214	6.7000E-01	4.0200E-02

23949	7/ 7/82	GAMMA	PB-214	5.5000E-01	4.4000E-02
23950	7/ 7/82	GAMMA	PB-214	7.6000E-01	5.3200E-02
23950X	7/ 7/82	GAMMA	PB-214	7.1000E-01	5.6800E-02
23951	7/ 7/82	GAMMA	PB-214	8.1000E-01	5.6700E-02
23952	7/ 7/82	GAMMA	PB-214	7.1000E-01	4.9700E-02
15429	7/21/81	PO	PO-210	2.5230E+00	4.2160E-01
15430	7/21/81	PO	PO-210	9.5600E-01	1.6491E-01
15430X	7/21/81	PO	PO-210	8.5400E-01	1.6226E-01
15431	7/21/81	PO	PO-210	1.9950E+00	3.4100E-01
15432	7/21/81	PO	PO-210	1.3550E+00	2.5095E-01
15433	7/21/81	PO	PO-210	6.1300E-01	1.4400E-01
15434	7/21/81	PO	PO-210	2.9000E-01	9.5700E-02
15435	7/21/81	PO	PO-210	2.0900E-01	7.4801E-02
15436	7/21/81	PO	PO-210	8.6100E-01	1.7400E-01
15437	7/21/81	PO	PO-210	1.6320E+00	3.0700E-01
15438	7/21/81	PO	PO-210	7.9100E-01	1.5274E-01
15439	7/21/81	PO	PO-210	3.2130E+00	5.3200E-01
15441	7/21/81	PO	PO-210	1.7200E+00	3.2900E-01
15443	7/21/81	PO	PO-210	1.6760E+00	3.3200E-01
15446	7/21/81	PO	PO-210	1.1360E+00	2.4410E-01
15447	7/21/81	PO	PO-210	7.2600E-01	1.7000E-01
23940	7/ 7/82	PO	PO-210	2.1130E+00	3.4649E-01
23940X	7/ 7/82	PO	PO-210	2.1671E+00	3.5052E-01
23941	7/ 7/82	PO	PO-210	1.4122E+00	2.4571E-01
23942	7/ 7/82	PO	PO-210	1.4656E+00	2.6964E-01
23943	7/ 7/82	PO	PO-210	3.0941E+00	5.0859E-01
23944	7/ 7/82	PO	PO-210	2.1539E+00	4.0096E-01
23945	7/ 7/82	PO	PO-210	1.7184E+00	2.9389E-01
23946	7/ 7/82	PO	PO-210	9.0334E-01	1.6520E-01
23947	7/ 7/82	PO	PO-210	4.3526E+00	8.4545E-01
23948	7/ 7/82	PO	PO-210	2.6728E+00	4.5186E-01
23949	7/ 7/82	PO	PO-210	7.9233E-01	1.5607E-01
23950X	7/ 7/82	PO	PO-210	2.6014E+00	4.0819E-01
23951	7/ 7/82	PO	PO-210	2.6844E+00	4.4211E-01
23952	7/ 7/82	PO	PO-210	2.3634E+00	3.9339E-01
15429	7/21/81	RA	RA-226	8.7000E-01	4.3500E-02
15431	7/21/81	RA	RA-226	9.4000E-01	4.7000E-02
15433	7/21/81	RA	RA-226	1.4000E-01	3.0800E-02
15436	7/21/81	RA	RA-226	5.1000E-01	3.5700E-02
15437	7/21/81	RA	RA-226	1.1600E+00	4.6400E-02
15439	7/21/81	RA	RA-226	9.9000E-01	4.9500E-02
15441	7/21/81	RA	RA-226	6.8000E-01	4.0800E-02
15443	7/21/81	RA	RA-226	1.0600E+00	5.3000E-02
15446	7/21/81	RA	RA-226	6.6000E-01	3.9600E-02
15447	7/21/81	RA	RA-226	3.3000E-01	3.3000E-02
23940	7/ 7/82	RA	RA-226	1.0000E+00	4.0000E-02
23940X	7/ 7/82	RA	RA-226	1.1000E+00	4.4000E-02
23941	7/ 7/82	RA	RA-226	1.4000E+00	5.6000E-02
23942	7/ 7/82	RA	RA-226	4.2000E-01	3.3600E-02
23943	7/ 7/82	RA	RA-226	9.6000E-01	3.8400E-02
23944	7/ 7/82	RA	RA-226	1.0000E+00	5.0000E-02
23945	7/ 7/82	RA	RA-226	6.9000E-01	4.1400E-02
23946	7/ 7/82	RA	RA-226	1.0700E+00	4.2800E-02
23947	7/ 7/82	RA	RA-226	1.0400E+00	4.1600E-02
23948	7/ 7/82	RA	RA-226	9.1000E-01	4.5500E-02

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23949     7/ 7/82   RA        RA-226    9.7000E-01   4.8500E-02
23950     7/ 7/82   RA        RA-226    9.8000E-01   3.9200E-02
23950X    7/ 7/82   RA        RA-226    1.0300E+00   4.1200E-02
23951     7/ 7/82   RA        RA-226    9.6000E-01   4.8000E-02
23952     7/ 7/82   RA        RA-226    9.9000E-01   3.9600E-02
15429     7/21/81   TH        TH-227    3.1890E-01   1.0260E-01
15431     7/21/81   TH        TH-227    1.1300E-01   5.8760E-02
15433     7/21/81   TH        TH-227    2.4500E-04   4.0932E-02
15436     7/21/81   TH        TH-227    5.3000E-02   5.0350E-02
15437     7/21/81   TH        TH-227    1.6900E-01   8.1120E-02
15439     7/21/81   TH        TH-227    6.2930E-02   3.6910E-02
15441     7/21/81   TH        TH-227    8.4400E-02   5.5704E-02
15443     7/21/81   TH        TH-227    3.4240E-02   3.1380E-02
15446     7/21/81   TH        TH-227    7.1360E-02   3.3680E-02
15447     7/21/81   TH        TH-227    2.9000E-02   3.5670E-02
23940X    7/ 7/82   TH        TH-227    1.1340E-01   3.6890E-02
23941     7/ 7/82   TH        TH-227    1.1790E-01   4.8090E-02
23942     7/ 7/82   TH        TH-227    5.2640E-02   3.3760E-02
23943     7/ 7/82   TH        TH-227    1.3110E-01   4.1150E-02
23944     7/ 7/82   TH        TH-227    1.9890E-01   5.6200E-02
23945     7/ 7/82   TH        TH-227    7.1760E-02   3.3520E-02
23946     7/ 7/82   TH        TH-227    3.6730E-01   7.1760E-02
23947     7/ 7/82   TH        TH-227    4.3160E-01   7.7510E-02
23948     7/ 7/82   TH        TH-227    5.3740E-01   9.1460E-02
23949     7/ 7/82   TH        TH-227    3.8660E-01   7.6890E-02
23950X    7/ 7/82   TH        TH-227    4.0610E-01   7.5820E-02
23951     7/ 7/82   TH        TH-227    3.1130E-01   6.7250E-02
23952     7/ 7/82   TH        TH-227    2.4700E-01   5.9280E-02
15429     7/21/81   TH        TH-228    1.0360E+00   1.5410E-01
15431     7/21/81   TH        TH-228    9.2600E-01   1.2964E-01
15433     7/21/81   TH        TH-228    2.0895E-01   9.8206E-02
15436     7/21/81   TH        TH-228    5.2200E-01   1.1484E-01
15437     7/21/81   TH        TH-228    8.3300E-01   1.3328E-01
15439     7/21/81   TH        TH-228    9.2450E-01   8.8260E-02
15441     7/21/81   TH        TH-228    5.3600E-01   1.1792E-01
15443     7/21/81   TH        TH-228    1.0740E+00   1.0220E-01
15446     7/21/81   TH        TH-228    7.6560E-01   9.0120E-02
15447     7/21/81   TH        TH-228    1.6900E-01   8.4500E-02
23940X    7/ 7/82   TH        TH-228    1.1410E+00   1.0700E-01
23941     7/ 7/82   TH        TH-228    1.1350E+00   1.1910E-01
23942     7/ 7/82   TH        TH-228    4.5660E-01   7.0760E-02
23943     7/ 7/82   TH        TH-228    9.0410E-01   9.5370E-02
23944     7/ 7/82   TH        TH-228    9.0940E-01   1.0000E-01
23945     7/ 7/82   TH        TH-228    4.6790E-01   6.8290E-02
23946     7/ 7/82   TH        TH-228    9.7310E-01   9.1050E-02
23947     7/ 7/82   TH        TH-228    1.1840E+00   9.8350E-02
23948     7/ 7/82   TH        TH-228    1.0450E+00   9.7730E-02
23949     7/ 7/82   TH        TH-228    8.0820E-01   8.5890E-02
23950X    7/ 7/82   TH        TH-228    1.0180E+00   9.0330E-02
23951     7/ 7/82   TH        TH-228    1.1730E+00   9.9380E-02
23952     7/ 7/82   TH        TH-228    9.1900E-01   8.2710E-02
15429     7/21/81   TH        TH-230    9.7530E-01   1.2590E-01
15431     7/21/81   TH        TH-230    8.9000E-01   1.1570E-01
15433     7/21/81   TH        TH-230    1.5820E-01   5.6161E-02
15436     7/21/81   TH        TH-230    5.2400E-01   8.9080E-02
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15437	7/21/81	TH	TH-230	9.2600E-01	1.2038E-01
15439	7/21/81	TH	TH-230	1.1110E+00	8.8080E-02
15441	7/21/81	TH	TH-230	7.7300E-01	1.1595E-01
15443	7/21/81	TH	TH-230	8.6560E-01	8.2210E-02
15446	7/21/81	TH	TH-230	6.0890E-01	6.9840E-02
15447	7/21/81	TH	TH-230	1.6800E-01	5.3760E-02
23940X	7/ 7/82	TH	TH-230	9.6450E-01	9.1790E-02
23941	7/ 7/82	TH	TH-230	1.5040E+00	1.3810E-01
23942	7/ 7/82	TH	TH-230	5.5410E-01	7.0680E-02
23943	7/ 7/82	TH	TH-230	1.0140E+00	9.8340E-02
23944	7/ 7/82	TH	TH-230	1.0630E+00	1.0470E-01
23945	7/ 7/82	TH	TH-230	6.0590E-01	7.0820E-02
23946	7/ 7/82	TH	TH-230	9.3920E-01	8.4110E-02
23947	7/ 7/82	TH	TH-230	1.3020E+00	9.8630E-02
23948	7/ 7/82	TH	TH-230	1.1200E+00	9.5270E-02
23949	7/ 7/82	TH	TH-230	7.6650E-01	7.6160E-02
23950X	7/ 7/82	TH	TH-230	1.2420E+00	9.5220E-02
23951	7/ 7/82	TH	TH-230	1.2490E+00	9.7260E-02
23952	7/ 7/82	TH	TH-230	1.2200E+00	9.7600E-02
15429	7/21/81	GAMMA	TH-232	2.1500E+00	1.5050E-01
15430	7/21/81	GAMMA	TH-232	1.1000E+00	2.5300E-01
15430X	7/21/81	GAMMA	TH-232	1.0000E+00	2.9000E-01
15431	7/21/81	GAMMA	TH-232	1.4690E+00	1.1752E-01
15432	7/21/81	GAMMA	TH-232	6.6000E-01	1.2540E-01
15433	7/21/81	GAMMA	TH-232	2.2100E-01	3.5360E-02
15434	7/21/81	GAMMA	TH-232	2.7000E-01	1.5390E-01
15435	7/21/81	GAMMA	TH-232	9.2000E-02	2.3000E-02
15436	7/21/81	GAMMA	TH-232	5.7700E-01	4.6160E-02
15437	7/21/81	GAMMA	TH-232	1.2910E+00	1.4201E-01
15438	7/21/81	GAMMA	TH-232	7.2000E-01	2.3760E-01
15439	7/21/81	GAMMA	TH-232	2.7860E+00	1.9502E-01
15441	7/21/81	GAMMA	TH-232	1.2080E+00	1.2080E-01
15443	7/21/81	GAMMA	TH-232	1.6100E+00	1.2880E-01
15446	7/21/81	GAMMA	TH-232	1.0470E+00	7.3290E-02
15447	7/21/81	GAMMA	TH-232	2.0800E-01	3.1200E-02
23940	7/ 7/82	GAMMA	TH-232	9.4800E-01	6.6360E-02
23941	7/ 7/82	GAMMA	TH-232	9.9500E-01	5.9700E-02
23942	7/ 7/82	GAMMA	TH-232	1.0700E+00	5.3500E-02
23943	7/ 7/82	GAMMA	TH-232	6.6300E-01	7.9560E-02
23944	7/ 7/82	GAMMA	TH-232	7.0900E-01	9.2170E-02
23945	7/ 7/82	GAMMA	TH-232	5.1700E-01	5.1700E-02
23946	7/ 7/82	GAMMA	TH-232	8.0000E-01	7.2000E-02
23947	7/ 7/82	GAMMA	TH-232	7.7000E-01	1.0010E-01
23948	7/ 7/82	GAMMA	TH-232	7.8000E-01	8.5800E-02
23949	7/ 7/82	GAMMA	TH-232	6.7000E-01	6.0300E-02
23950	7/ 7/82	GAMMA	TH-232	8.0000E-01	9.6000E-02
23950X	7/ 7/82	GAMMA	TH-232	7.6000E-01	9.8800E-02
23951	7/ 7/82	GAMMA	TH-232	8.6000E-01	1.1180E-01
23952	7/ 7/82	GAMMA	TH-232	7.8000E-01	9.3600E-02
15429	7/21/81	TH	TH-232	1.1570E+00	1.3800E-01
15431	7/21/81	TH	TH-232	1.0390E+00	1.2468E-01
15433	7/21/81	TH	TH-232	1.5830E-01	6.0154E-02
15436	7/21/81	TH	TH-232	6.3000E-01	1.0080E-01
15437	7/21/81	TH	TH-232	1.1100E+00	1.3320E-01
15439	7/21/81	TH	TH-232	1.1700E+00	9.0700E-02

15441	7/21/81	TH	TH-232	8.0990E-01	1.1339E-01
15443	7/21/81	TH	TH-232	1.0990E+00	9.3360E-02
15446	7/21/81	TH	TH-232	9.5520E-01	8.8300E-02
15447	7/21/81	TH	TH-232	1.5100E-01	4.6810E-02
23940X	7/ 7/82	TH	TH-232	1.1600E+00	1.0420E-01
23941	7/ 7/82	TH	TH-232	1.4760E+00	1.3630E-01
23942	7/ 7/82	TH	TH-232	4.9450E-01	6.5580E-02
23943	7/ 7/82	TH	TH-232	1.1190E+00	1.0470E-01
23944	7/ 7/82	TH	TH-232	1.1170E+00	1.0850E-01
23945	7/ 7/82	TH	TH-232	6.6700E-01	7.5210E-02
23946	7/ 7/82	TH	TH-232	1.0180E+00	8.7350E-02
23947	7/ 7/82	TH	TH-232	1.5050E+00	1.0690E-01
23948	7/ 7/82	TH	TH-232	1.2650E+00	1.0220E-01
23949	7/ 7/82	TH	TH-232	8.5320E-01	8.0540E-02
23950X	7/ 7/82	TH	TH-232	1.3630E+00	1.0030E-01
23951	7/ 7/82	TH	TH-232	1.2380E+00	9.6650E-02
23952	7/ 7/82	TH	TH-232	1.2780E+00	1.0224E-01
15429	7/21/81	U	U-234	8.4490E-01	1.5060E-01
15431	7/21/81	U	U-234	8.4400E-01	1.5192E-01
15433	7/21/81	U	U-234	1.8800E-01	7.1440E-02
15436	7/21/81	U	U-234	5.9400E-01	1.2474E-01
15437	7/21/81	U	U-234	1.0530E+00	1.8954E-01
15439	7/21/81	U	U-234	9.6200E-01	1.2630E-01
15441	7/21/81	U	U-234	1.0630E+00	1.7008E-01
15443	7/21/81	U	U-234	7.5990E-01	1.0770E-01
15446	7/21/81	U	U-234	6.6490E-01	9.8140E-02
15447	7/21/81	U	U-234	5.1200E-01	1.1264E-01
23940X	7/ 7/82	U	U-234	1.2920E+00	1.8210E-01
23941	7/ 7/82	U	U-234	1.4000E+00	2.0950E-01
23942	7/ 7/82	U	U-234	5.7920E-01	1.1320E-01
23943	7/ 7/82	U	U-234	1.1470E+00	1.6340E-01
23944	7/ 7/82	U	U-234	1.2040E+00	1.8290E-01
23945	7/ 7/82	U	U-234	6.0910E-01	9.6280E-02
23946	7/ 7/82	U	U-234	8.9310E-01	1.2150E-01
23947	7/ 7/82	U	U-234	1.1470E+00	1.4780E-01
23948	7/ 7/82	U	U-234	9.5090E-01	1.3830E-01
23949	7/ 7/82	U	U-234	1.3720E+00	1.8500E-01
23950X	7/ 7/82	U	U-234	1.2770E+00	1.6680E-01
23951	7/ 7/82	U	U-234	1.0970E+00	1.5050E-01
23952	7/ 7/82	U	U-234	1.1540E+00	1.5450E-01
15429	7/21/81	U	U-235	4.4470E-02	2.9570E-02
15431	7/21/81	U	U-235	3.2000E-02	3.0080E-02
15433	7/21/81	U	U-235	2.3000E-02	2.0700E-02
15436	7/21/81	U	U-235	3.6000E-02	2.8800E-02
15437	7/21/81	U	U-235	4.3000E-02	3.2250E-02
15439	7/21/81	U	U-235	1.0570E-01	3.1670E-02
15441	7/21/81	U	U-235	3.3700E-02	2.4938E-02
15443	7/21/81	U	U-235	9.5820E-02	3.1130E-02
15446	7/21/81	U	U-235	5.6540E-02	2.3180E-02
15447	7/21/81	U	U-235	2.0000E-02	2.6600E-02
23940X	7/ 7/82	U	U-235	3.7190E-02	1.9340E-02
23941	7/ 7/82	U	U-235	1.0930E-01	4.0070E-02
23942	7/ 7/82	U	U-235	1.2320E-01	4.3250E-02
23943	7/ 7/82	U	U-235	7.6600E-02	2.7290E-02
23944	7/ 7/82	U	U-235	8.8600E-02	3.2190E-02

23945	7/ 7/82	U	U-235	7.6640E-02	2.6830E-02
23946	7/ 7/82	U	U-235	1.6370E-02	1.1850E-02
23947	7/ 7/82	U	U-235	2.1530E-02	1.3290E-02
23948	7/ 7/82	U	U-235	5.2130E-02	2.1640E-02
23949	7/ 7/82	U	U-235	6.1710E-02	2.5360E-02
23950X	7/ 7/82	U	U-235	5.2480E-02	2.0700E-02
23951	7/ 7/82	U	U-235	4.9010E-02	2.0500E-02
23952	7/ 7/82	U	U-235	3.1720E-02	1.6680E-02
15429	7/21/81	GAMMA	U-238	6.0870E+00	4.4435E+00
15431	7/21/81	GAMMA	U-238	4.1980E+00	3.1485E+00
15439	7/21/81	GAMMA	U-238	8.6350E+00	5.7855E+00
15443	7/21/81	GAMMA	U-238	3.6600E+00	3.4038E+00
15446	7/21/81	GAMMA	U-238	1.9930E+00	1.4350E+00
15447	7/21/81	GAMMA	U-238	1.0880E+00	3.8080E-01
23940	7/ 7/82	GAMMA	U-238	0.0000E-01	0.0000E-01
23942	7/ 7/82	GAMMA	U-238	2.0400E+00	1.7748E+00
23949	7/ 7/82	GAMMA	U-238	3.9200E+00	2.1952E+00
15429	7/21/81	U	U-238	7.8020E-01	1.4170E-01
15431	7/21/81	U	U-238	6.3100E-01	1.1989E-01
15433	7/21/81	U	U-238	1.7400E-01	6.4380E-02
15436	7/21/81	U	U-238	3.3600E-01	8.7360E-02
15437	7/21/81	U	U-238	8.6400E-01	1.6416E-01
15439	7/21/81	U	U-238	8.8220E-01	1.1880E-01
15441	7/21/81	U	U-238	6.0660E-01	1.1525E-01
15443	7/21/81	U	U-238	6.1950E-01	9.3120E-02
15446	7/21/81	U	U-238	5.4500E-01	8.5630E-02
15447	7/21/81	U	U-238	2.3200E-01	6.9600E-02
23940X	7/ 7/82	U	U-238	1.3040E+00	1.8350E-01
23941	7/ 7/82	U	U-238	1.3460E+00	2.0330E-01
23942	7/ 7/82	U	U-238	4.5270E-01	9.6080E-02
23943	7/ 7/82	U	U-238	1.0290E+00	1.4970E-01
23944	7/ 7/82	U	U-238	1.0580E+00	1.6500E-01
23945	7/ 7/82	U	U-238	5.5670E-01	9.0350E-02
23946	7/ 7/82	U	U-238	8.7270E-01	1.1930E-01
23947	7/ 7/82	U	U-238	1.0440E+00	1.3690E-01
23948	7/ 7/82	U	U-238	9.4250E-01	1.3740E-01
23949	7/ 7/82	U	U-238	1.1380E+00	1.5850E-01
23950X	7/ 7/82	U	U-238	1.1760E+00	1.5580E-01
23951	7/ 7/82	U	U-238	9.5800E-01	1.3500E-01
23952	7/ 7/82	U	U-238	1.0700E+00	1.4540E-01

GROSS ALPHA

15429	7/21/81	ALPHA	ALPHA	1.8000E+00	2.6820E+00
15431	7/21/81	ALPHA	ALPHA	4.4000E+00	4.2240E+00
15433	7/21/81	ALPHA	ALPHA	4.4000E+00	3.8720E+00
15435	7/21/81	ALPHA	ALPHA	1.2580E+00	1.8744E+00
15436	7/21/81	ALPHA	ALPHA	6.2000E+00	4.4020E+00
15437	7/21/81	ALPHA	ALPHA	5.0000E+00	4.4000E+00
15438	7/21/81	ALPHA	ALPHA	3.0630E+00	4.6251E+00
15439	7/21/81	ALPHA	ALPHA	2.6000E+00	3.6660E+00
15441	7/21/81	ALPHA	ALPHA	6.6000E+00	4.3560E+00
15443	7/21/81	ALPHA	ALPHA	6.2000E+00	4.4020E+00
15446	7/21/81	ALPHA	ALPHA	1.9000E+00	3.0020E+00
15447	7/21/81	ALPHA	ALPHA	-4.0000E-01	2.8600E+00

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23940     7/ 7/82   ALPHA      ALPHA      1.4600E+01   2.7740E+00
23940X    7/ 7/82   ALPHA      ALPHA      1.3900E+01   2.7800E+00
23941     7/ 7/82   ALPHA      ALPHA      7.3000E+00   2.0440E+00
23942     7/ 7/82   ALPHA      ALPHA      6.8000E+00   2.0400E+00
23943     7/ 7/82   ALPHA      ALPHA      4.0000E+00   3.6400E+00
23944     7/ 7/82   ALPHA      ALPHA      6.5000E+00   1.9500E+00
23945     7/ 7/82   ALPHA      ALPHA      6.8000E+00   2.1760E+00
23946     7/ 7/82   ALPHA      ALPHA      7.3000E+00   2.0440E+00
23947     7/ 7/82   ALPHA      ALPHA      1.2700E+01   2.6670E+00
23948     7/ 7/82   ALPHA      ALPHA      6.6000E+00   1.9800E+00
23949     7/ 7/82   ALPHA      ALPHA      5.9000E+00   1.9470E+00
23950     7/ 7/82   ALPHA      ALPHA      8.9000E+00   2.4030E+00
23950X    7/ 7/82   ALPHA      ALPHA      7.0000E+00   2.0300E+00
23951     7/ 7/82   ALPHA      ALPHA      8.9000E+00   2.2250E+00
23952     7/ 7/82   ALPHA      ALPHA      6.1000E+00   1.8910E+00

          GROSS BETA

15429     7/21/81   BETA       BETA       2.2500E+01   3.6000E+00
15431     7/21/81   BETA       BETA       1.0800E+01   3.7800E+00
15433     7/21/81   BETA       BETA       7.8000E+00   2.1060E+00
15435     7/21/81   BETA       BETA       6.2900E-01   3.7111E-01
15436     7/21/81   BETA       BETA       8.5000E+00   2.1250E+00
15437     7/21/81   BETA       BETA      -1.0400E+01   2.9120E+00
15438     7/21/81   BETA       BETA       3.3690E+01   4.3797E+00
15439     7/21/81   BETA       BETA       1.7600E+01   4.0480E+00
15441     7/21/81   BETA       BETA       2.0800E+01   3.5360E+00
15443     7/21/81   BETA       BETA       2.9500E+01   3.2450E+00
15446     7/21/81   BETA       BETA       1.9600E+01   2.7440E+00
15447     7/21/81   BETA       BETA      -1.3900E+01   2.9190E+00
23940     7/ 7/82   BETA       BETA       3.3400E+01   2.0040E+00
23940X    7/ 7/82   BETA       BETA       3.5200E+01   1.7600E+00
23941     7/ 7/82   BETA       BETA       4.7400E+01   2.3700E+00
23942     7/ 7/82   BETA       BETA       1.3500E+01   1.2150E+00
23943     7/ 7/82   BETA       BETA       3.7800E+01   1.8900E+00
23944     7/ 7/82   BETA       BETA       3.7100E+01   1.8550E+00
23945     7/ 7/82   BETA       BETA       2.9000E+01   1.7400E+00
23946     7/ 7/82   BETA       BETA       2.7000E+01   1.6200E+00
23947     7/ 7/82   BETA       BETA       4.2500E+01   2.1250E+00
23948     7/ 7/82   BETA       BETA       3.2100E+01   1.9260E+00
23949     7/ 7/82   BETA       BETA       2.9600E+01   1.7760E+00
23950     7/ 7/82   BETA       BETA       4.3000E+01   2.1500E+00
23950X    7/ 7/82   BETA       BETA       4.3900E+01   2.1950E+00
23951     7/ 7/82   BETA       BETA       4.2800E+01   2.1400E+00
23952     7/ 7/82   BETA       BETA       3.1600E+01   1.8960E+00
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APPENDIX C

BERF ANALYSES OF FDA MARKETPLACE SEAFOOD SAMPLES FROM BOSTON, 1981-1982

Radionuclide Analyses of FDA Marketplace Seafood Samples
1981 and 1982

Sample Number	Date Collected	Sample Type	Analysis	Nuclide	Activity pCi/g (wet)	2-Sigma Error
	MAN-MADE NUCLIDES					
15993	9/ 2/81	FLOUNDER	GAMMA	CS-137	1.7000E-02	1.2920E-02
15994	9/ 2/81	FLOUNDER	GAMMA	CS-137	1.3000E-02	8.8400E-03
16843	9/10/81	CUSK EEL	GAMMA	CS-137	3.1000E-02	1.1160E-02
26959	9/13/82	HAKE	GAMMA	CS-137	1.4000E-02	1.0080E-02
26960	9/13/82	COD	GAMMA	CS-137	2.5000E-02	1.4500E-02
26962	11/ 2/82	COD	GAMMA	CS-137	5.0000E-03	3.3000E-03
26963	11/ 2/82	POLLOCK	GAMMA	CS-137	1.5000E-02	1.1250E-02
15991	9/ 2/81	FLOUNDER	PU	PU-238	7.0000E-05	1.7150E-04
15992	9/ 2/81	FLOUNDER	PU	PU-238	3.0000E-04	1.4400E-04
15993	9/ 2/81	FLOUNDER	PU	PU-238	-1.0000E-05	9.1700E-05
15994	9/ 2/81	FLOUNDER	PU	PU-238	8.0000E-05	1.1360E-04
16842	9/10/81	HAKE	PU	PU-238	0.0000E-01	0.0000E-01
16843	9/10/81	CUSK EEL	PU	PU-238	5.7566E-04	7.2211E-04
16844	9/21/81	FLOUNDER	PU	PU-238	1.7000E-03	1.0370E-03
16845	9/21/81	COD	PU	PU-238	8.0000E-04	7.4400E-04
26958	6/10/82	FLOUNDER	PU	PU-238	5.7180E-05	1.3760E-04
26959	9/13/82	HAKE	PU	PU-238	2.8460E-04	1.5580E-04
26960	9/13/82	COD	PU	PU-238	2.1120E-05	1.0970E-04
26960X	9/13/82	COD	PU	PU-238	7.0140E-05	3.1660E-04
26961	11/ 2/82	HADDOCK	PU	PU-238	1.0800E-04	1.8710E-04
26962	11/ 2/82	COD	PU	PU-238	2.5950E-04	2.0600E-04
26963	11/ 2/82	POLLOCK	PU	PU-238	2.4510E-04	1.5090E-04
15991	9/ 2/81	FLOUNDER	PU	PU-239	3.0000E-05	7.3500E-05
15992	9/ 2/81	FLOUNDER	PU	PU-239	1.0000E-04	6.7000E-05
15993	9/ 2/81	FLOUNDER	PU	PU-239	2.0000E-05	4.0000E-05
15994	9/ 2/81	FLOUNDER	PU	PU-239	9.0000E-05	7.7400E-05
16842	9/10/81	HAKE	PU	PU-239	2.0000E-05	8.9400E-05
16843	9/10/81	CUSK EEL	PU	PU-239	8.2232E-05	1.6491E-04
16844	9/21/81	FLOUNDER	PU	PU-239	1.0000E-04	2.0100E-04
16845	9/21/81	COD	PU	PU-239	-3.0000E-04	2.7300E-04
26958	6/10/82	FLOUNDER	PU	PU-239	-1.9060E-05	8.5260E-05
26959	9/13/82	HAKE	PU	PU-239	1.0160E-04	9.1700E-05
26960	9/13/82	COD	PU	PU-239	4.8180E-06	1.7750E-05
26960X	9/13/82	COD	PU	PU-239	-4.2850E-05	8.5950E-05
26961	11/ 2/82	HADDOCK	PU	PU-239	2.1370E-05	4.5930E-05
26962	11/ 2/82	COD	PU	PU-239	-3.9520E-05	7.9250E-05
26963	11/ 2/82	POLLOCK	PU	PU-239	1.6970E-04	1.2490E-04
15991	9/ 2/81	FLOUNDER	SR	SR-90	4.0000E-04	1.2920E-03
15992	9/ 2/81	FLOUNDER	SR	SR-90	3.0000E-04	3.0000E-04
15993	9/ 2/81	FLOUNDER	SR	SR-90	2.6000E-03	5.9800E-03
15994	9/ 2/81	FLOUNDER	SR	SR-90	-2.0000E-04	6.0000E-04
16842	9/10/81	HAKE	SR	SR-90	-2.5680E-04	3.4239E-04
16843	9/10/81	CUSK EEL	SR	SR-90	2.2084E-04	4.4168E-04
16844	9/21/81	FLOUNDER	SR	SR-90	2.1484E-04	4.2968E-04
16845	9/21/81	COD	SR	SR-90	-2.0715E-04	4.1430E-04
26958	6/10/82	FLOUNDER	SR	SR-90	-2.1000E-03	7.3500E-04

26959	9/13/82	HAKE	SR	SR-90	-1.0000E-03	2.0000E-04
26960	9/13/82	COD	SR	SR-90	-6.0000E-04	9.0000E-04
26960X	9/13/82	COD	SR	SR-90	1.0000E-03	1.0000E-03
26961	11/ 2/82	HADDOCK	SR	SR-90	-1.0000E-03	1.2000E-03
26962	11/ 2/82	COD	SR	SR-90	-1.0000E-03	1.2700E-03
26963	11/ 2/82	POLLOCK	SR	SR-90	1.0000E-03	1.7500E-03

NATURAL NUCLIDES

15991	9/ 2/81	FLOUNDER	GAMMA	K-40	2.9000E+00	3.7700E-01
15992	9/ 2/81	FLOUNDER	GAMMA	K-40	3.2000E+00	2.5600E-01
15993	9/ 2/81	FLOUNDER	GAMMA	K-40	3.1000E+00	2.7900E-01
15994	9/ 2/81	FLOUNDER	GAMMA	K-40	3.0000E+00	2.1000E-01
16842	9/10/81	HAKE	GAMMA	K-40	2.8000E+00	3.6400E-01
16843	9/10/81	CUSK EEL	GAMMA	K-40	3.1000E+00	2.4800E-01
16844	9/21/81	FLOUNDER	GAMMA	K-40	2.7000E+00	2.1600E-01
16845	9/21/81	COD	GAMMA	K-40	3.4000E+00	2.0400E-01
26958	6/10/82	FLOUNDER	GAMMA	K-40	3.4000E+00	4.4200E-01
26959	9/13/82	HAKE	GAMMA	K-40	3.6000E+00	2.8800E-01
26960	9/13/82	COD	GAMMA	K-40	3.0000E+00	3.0000E-01
26960X	9/13/82	COD	GAMMA	K-40	3.2000E+00	2.8800E-01
26961	11/ 2/82	HADDOCK	GAMMA	K-40	3.5000E+00	4.9000E-01
26962	11/ 2/82	COD	GAMMA	K-40	3.8000E+00	2.2800E-01
26963	11/ 2/82	POLLOCK	GAMMA	K-40	3.9000E+00	3.1200E-01
15991	9/ 2/81	FLOUNDER	PB	PB-210	1.9600E-01	3.2405E-01
15992	9/ 2/81	FLOUNDER	PB	PB-210	1.0600E+00	7.1624E-01
15993	9/ 2/81	FLOUNDER	PB	PB-210	3.4600E-01	4.1032E-01
15994	9/ 2/81	FLOUNDER	PB	PB-210	3.5350E-01	5.2880E-01
16842	9/10/81	HAKE	PB	PB-210	2.5800E-01	4.5408E-01
16843	9/10/81	CUSK EEL	PB	PB-210	1.0690E-01	4.1021E-01
16844	9/21/81	FLOUNDER	PB	PB-210	1.1255E-03	2.9518E-01
16845	9/21/81	COD	PB	PB-210	4.2463E-01	4.6463E-01
26958	6/10/82	FLOUNDER	PB	PB-210	-7.5977E-03	1.9284E-01
26959	9/13/82	HAKE	PB	PB-210	-6.8101E-02	1.2003E-01
26960	9/13/82	COD	PB	PB-210	-3.3857E-02	1.0053E-01
26960X	9/13/82	COD	PB	PB-210	5.9297E-02	1.4097E-01
26961	11/ 2/82	HADDOCK	PB	PB-210	2.1966E-01	2.7060E-01
26962	11/ 2/82	COD	PB	PB-210	7.2815E-02	1.7233E-01
26963	11/ 2/82	POLLOCK	PB	PB-210	-5.6450E-02	1.4744E-01
15991	9/ 2/81	FLOUNDER	PO	PO-210	2.2000E-02	1.2817E-02
15992	9/ 2/81	FLOUNDER	PO	PO-210	9.5000E-03	1.0275E-02
15993	9/ 2/81	FLOUNDER	PO	PO-210	1.5000E-03	1.1220E-03
15994	9/ 2/81	FLOUNDER	PO	PO-210	4.0000E-04	5.5459E-03
16842	9/10/81	HAKE	PO	PO-210	2.4450E-03	5.6646E-03
16843	9/10/81	CUSK EEL	PO	PO-210	1.0800E-02	9.2880E-03
16844	9/21/81	FLOUNDER	PO	PO-210	5.5000E-03	5.4450E-03
16845	9/21/81	COD	PO	PO-210	1.6150E-03	5.3926E-03
26958	6/10/82	FLOUNDER	PO	PO-210	1.1164E-02	6.5512E-03
26959	9/13/82	HAKE	PO	PO-210	5.3392E-03	3.4434E-03
26960	9/13/82	COD	PO	PO-210	5.9960E-03	3.8234E-03
26960X	9/13/82	COD	PO	PO-210	5.3739E-03	3.6929E-03
26961	11/ 2/82	HADDOCK	PO	PO-210	6.0917E-03	5.3091E-03
26962	11/ 2/82	COD	PO	PO-210	1.2251E-03	2.7398E-03
26963	11/ 2/82	POLLOCK	PO	PO-210	6.7306E-03	4.7131E-03
15991	9/ 2/81	FLOUNDER	RA	RA-226	1.3000E-03	3.1200E-04

15992	9/ 2/81	FLOUNDER	RA	RA-226	2.0000E-03	4.0000E-04
15993	9/ 2/81	FLOUNDER	RA	RA-226	1.2000E-03	2.6400E-04
15994	9/ 2/81	FLOUNDER	RA	RA-226	2.4000E-03	3.1200E-04
16842	9/10/81	HAKE	RA	RA-226	2.0000E-03	2.2000E-04
16843	9/10/81	CUSK EEL	RA	RA-226	3.0000E-03	3.3000E-04
16844	9/21/81	FLOUNDER	RA	RA-226	1.5000E-03	3.3000E-04
16845	9/21/81	COD	RA	RA-226	1.1000E-03	2.9700E-04
26958	6/10/82	FLOUNDER	RA	RA-226	3.0000E-03	3.6000E-04
26959	9/13/82	HAKE	RA	RA-226	2.0000E-03	3.0000E-04
26960	9/13/82	COD	RA	RA-226	2.0000E-03	3.2000E-04
26960X	9/13/82	COD	RA	RA-226	2.0000E-03	3.4000E-04
26961	11/ 2/82	HADDOCK	RA	RA-226	2.0000E-03	3.0000E-04
26962	11/ 2/82	COD	RA	RA-226	2.0000E-03	3.4000E-04
26963	11/ 2/82	POLLOCK	RA	RA-226	3.0000E-03	4.5000E-04
15991	9/ 2/81	FLOUNDER	TH	TH-227	2.5000E-04	1.6750E-04
15992	9/ 2/81	FLOUNDER	TH	TH-227	1.8000E-04	1.8900E-04
15993	9/ 2/81	FLOUNDER	TH	TH-227	2.0000E-04	1.4200E-04
15994	9/ 2/81	FLOUNDER	TH	TH-227	-8.0000E-05	4.2320E-04
16842	9/10/81	HAKE	TH	TH-227	5.0000E-04	2.7000E-04
16843	9/10/81	CUSK EEL	TH	TH-227	3.0000E-04	2.5800E-04
16844	9/21/81	FLOUNDER	TH	TH-227	1.0000E-04	1.4100E-04
16845	9/21/81	COD	TH	TH-227	4.0000E-04	3.6000E-04
26958	6/10/82	FLOUNDER	TH	TH-227	6.9900E-04	3.5010E-04
26959	9/13/82	HAKE	TH	TH-227	3.3870E-04	2.5630E-04
26960	9/13/82	COD	TH	TH-227	1.2170E-04	2.1470E-04
26961	11/ 2/82	HADDOCK	TH	TH-227	9.2740E-05	2.2720E-04
26962	11/ 2/82	COD	TH	TH-227	7.2630E-05	2.5160E-04
26963	11/ 2/82	POLLOCK	TH	TH-227	9.5290E-05	1.3480E-04
15991	9/ 2/81	FLOUNDER	TH	TH-228	2.0000E-05	2.7080E-04
15992	9/ 2/81	FLOUNDER	TH	TH-228	4.0000E-05	3.7480E-04
15993	9/ 2/81	FLOUNDER	TH	TH-228	-1.0000E-04	2.4600E-04
15994	9/ 2/81	FLOUNDER	TH	TH-228	-8.0000E-04	5.0400E-04
16842	9/10/81	HAKE	TH	TH-228	-1.0000E-04	3.5000E-04
16843	9/10/81	CUSK EEL	TH	TH-228	-4.0000E-04	3.3600E-04
16844	9/21/81	FLOUNDER	TH	TH-228	-4.0000E-04	4.3200E-04
16845	9/21/81	COD	TH	TH-228	-3.0000E-04	5.1900E-04
26958	6/10/82	FLOUNDER	TH	TH-228	-1.0060E-03	2.9650E-04
26959	9/13/82	HAKE	TH	TH-228	-5.2310E-04	3.9820E-04
26960	9/13/82	COD	TH	TH-228	6.0200E-05	3.5940E-04
26961	11/ 2/82	HADDOCK	TH	TH-228	-1.2190E-04	3.7820E-04
26962	11/ 2/82	COD	TH	TH-228	-1.2120E-04	5.0350E-04
26963	11/ 2/82	POLLOCK	TH	TH-228	4.5580E-04	4.3570E-04
15991	9/ 2/81	FLOUNDER	TH	TH-230	4.0000E-04	1.6000E-04
15992	9/ 2/81	FLOUNDER	TH	TH-230	5.0000E-04	2.0000E-04
15993	9/ 2/81	FLOUNDER	TH	TH-230	5.0000E-04	1.7500E-04
15994	9/ 2/81	FLOUNDER	TH	TH-230	2.0000E-04	2.6600E-04
16842	9/10/81	HAKE	TH	TH-230	7.0000E-04	2.3100E-04
16843	9/10/81	CUSK EEL	TH	TH-230	2.0000E-04	1.3400E-04
16844	9/21/81	FLOUNDER	TH	TH-230	6.0000E-04	2.5200E-04
16845	9/21/81	COD	TH	TH-230	7.0000E-04	3.2900E-04
26958	6/10/82	FLOUNDER	TH	TH-230	4.1940E-04	2.3010E-04
26959	9/13/82	HAKE	TH	TH-230	3.0190E-04	2.1310E-04
26960	9/13/82	COD	TH	TH-230	1.9470E-04	1.5590E-04
26961	11/ 2/82	HADDOCK	TH	TH-230	3.7840E-04	1.8390E-04
26962	11/ 2/82	COD	TH	TH-230	3.4860E-04	2.6110E-04

26963	11/ 2/82	POLLOCK	TH	TH-230	4.1170E-04	1.9440E-04
15991	9/ 2/81	FLOUNDER	TH	TH-232	1.0000E-04	6.9000E-05
15992	9/ 2/81	FLOUNDER	TH	TH-232	3.0000E-04	1.4400E-04
15993	9/ 2/81	FLOUNDER	TH	TH-232	1.0000E-04	6.7000E-05
15994	9/ 2/81	FLOUNDER	TH	TH-232	2.0000E-04	2.0000E-04
16842	9/10/81	HAKE	TH	TH-232	2.0000E-04	1.2400E-04
16843	9/10/81	CUSK EEL	TH	TH-232	2.0000E-04	1.3400E-04
16844	9/21/81	FLOUNDER	TH	TH-232	2.0000E-04	1.5800E-04
16845	9/21/81	COD	TH	TH-232	2.0000E-04	1.7800E-04
26958	6/10/82	FLOUNDER	TH	TH-232	2.7260E-04	1.8300E-04
26959	9/13/82	HAKE	TH	TH-232	1.6260E-04	1.3940E-04
26960	9/13/82	COD	TH	TH-232	9.7350E-05	1.0310E-04
26961	11/ 2/82	HADDOCK	TH	TH-232	8.9030E-05	8.9070E-05
26962	11/ 2/82	COD	TH	TH-232	2.0920E-04	2.2060E-04
26963	11/ 2/82	POLLOCK	TH	TH-232	1.1430E-04	1.0230E-04
15991	9/ 2/81	FLOUNDER	U	U-234	9.0000E-04	2.3400E-04
15992	9/ 2/81	FLOUNDER	U	U-234	9.9000E-04	2.4750E-04
15993	9/ 2/81	FLOUNDER	U	U-234	4.6230E-03	1.2950E-03
15994	9/ 2/81	FLOUNDER	U	U-234	6.0000E-04	1.9800E-04
16842	9/10/81	HAKE	U	U-234	5.0000E-04	1.9500E-04
16843	9/10/81	CUSK EEL	U	U-234	1.1700E-03	5.7903E-04
16844	9/21/81	FLOUNDER	U	U-234	1.8770E-03	1.0120E-03
16845	9/21/81	COD	U	U-234	1.1930E-03	6.8140E-04
26958	6/10/82	FLOUNDER	U	U-234	1.0890E-03	3.5790E-04
26959	9/13/82	HAKE	U	U-234	7.9800E-04	3.2380E-04
26960	9/13/82	COD	U	U-234	4.8190E-04	2.1930E-04
26961	11/ 2/82	HADDOCK	U	U-234	4.4890E-04	2.3180E-04
26962	11/ 2/82	COD	U	U-234	6.6060E-04	4.0110E-04
26963	11/ 2/82	POLLOCK	U	U-234	4.4630E-04	2.4890E-04
15991	9/ 2/81	FLOUNDER	U	U-235	2.0000E-04	1.2000E-04
15992	9/ 2/81	FLOUNDER	U	U-235	1.4000E-04	9.2400E-05
15993	9/ 2/81	FLOUNDER	U	U-235	1.3100E-02	7.8862E-03
15994	9/ 2/81	FLOUNDER	U	U-235	2.0000E-04	1.1600E-04
16842	9/10/81	HAKE	U	U-235	7.0000E-05	7.0700E-05
16843	9/10/81	CUSK EEL	U	U-235	6.2000E-05	2.1498E-04
16844	9/21/81	FLOUNDER	U	U-235	-3.7550E-04	4.6450E-04
16845	9/21/81	COD	U	U-235	0.0000E-01	0.0000E-01
26958	6/10/82	FLOUNDER	U	U-235	2.7200E-05	9.2740E-05
26959	9/13/82	HAKE	U	U-235	6.5560E-06	2.7520E-05
26960	9/13/82	COD	U	U-235	4.7800E-05	6.7460E-05
26961	11/ 2/82	HADDOCK	U	U-235	8.9410E-05	1.0180E-04
26962	11/ 2/82	COD	U	U-235	-5.0780E-05	1.0170E-04
26963	11/ 2/82	POLLOCK	U	U-235	0.0000E-01	0.0000E-01
15991	9/ 2/81	FLOUNDER	U	U-238	6.0000E-04	1.8600E-04
15992	9/ 2/81	FLOUNDER	U	U-238	6.0000E-04	1.8600E-04
15993	9/ 2/81	FLOUNDER	U	U-238	1.3110E-03	6.7220E-04
15994	9/ 2/81	FLOUNDER	U	U-238	3.0000E-04	1.2900E-04
16842	9/10/81	HAKE	U	U-238	4.0000E-04	1.7600E-04
16843	9/10/81	CUSK EEL	U	U-238	4.5800E-04	3.9860E-04
16844	9/21/81	FLOUNDER	U	U-238	8.4480E-04	6.9280E-04
16845	9/21/81	COD	U	U-238	1.1930E-03	6.8140E-04
26958	6/10/82	FLOUNDER	U	U-238	4.9930E-04	2.3610E-04
26959	9/13/82	HAKE	U	U-238	7.9920E-04	3.2400E-04
26960	9/13/82	COD	U	U-238	3.6780E-04	1.9040E-04
26961	11/ 2/82	HADDOCK	U	U-238	2.9500E-04	1.8660E-04

26962	11/ 2/82	COD	U	U-238	6.8560E-04	3.8180E-04
26963	11/ 2/82	POLLOCK	U	U-238	2.3680E-04	1.8900E-04

GROSS ALPHA

26958	6/10/82	FLOUNDER	ALPHA	ALPHA	-2.0000E-02	2.0000E-01
26959	9/13/82	HAKE	ALPHA	ALPHA	-2.0000E-02	1.9180E-01
26960	9/13/82	COD	ALPHA	ALPHA	-3.0000E-02	1.0380E-01
26960X	9/13/82	COD	ALPHA	ALPHA	-3.0000E-02	1.1220E-01
26961	11/ 2/82	HADDOCK	ALPHA	ALPHA	-2.0000E-02	1.4420E-01
26962	11/ 2/82	COD	ALPHA	ALPHA	-1.3000E-01	1.9370E-01
26963	11/ 2/82	POLLOCK	ALPHA	ALPHA	-1.5000E-01	2.1150E-01

GROSS BETA

26958	6/10/82	FLOUNDER	BETA	BETA	4.0000E+00	3.2000E-01
26959	9/13/82	HAKE	BETA	BETA	4.2000E+00	2.9400E-01
26960	9/13/82	COD	BETA	BETA	4.1000E+00	2.8700E-01
26960X	9/13/82	COD	BETA	BETA	4.0000E+00	2.8000E-01
26961	11/ 2/82	HADDOCK	BETA	BETA	3.1000E+00	2.4800E-01
26962	11/ 2/82	COD	BETA	BETA	3.8000E+00	2.6600E-01
26963	11/ 2/82	POLLOCK	BETA	BETA	3.7000E+00	2.9600E-01

APPENDIX D

EERF ANALYSES OF SAMPLES FROM EPA RADIOLOGICAL MONITORING SURVEY IN MASSACHUSETTS BAY -1982

CONTENTS

Edible Biota Samples D-1 to D-20

Nonedible Biota Samples D-21 to D-25

Sediment Samples D-26 to D-56

NOTE: Six digit sample numbers were used during this survey, as follows:

1st digit = Sampling (survey) area.

2nd and 3rd digits = Assigned sampling station numbers.

4th, 5th, and 6th digits = Consecutive sampling station numbers.

Example: 124092

1 = Area 1.

24 = Assigned station 24.

092 = Consecutive (total survey) station 92.

Radionuclide Analyses of Edible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

Sample Number	Sample Type	Analysis	Nuclide	Activity pCi/g (wet)	2-Sigma Error
	AREA 1 MAN-MADE NUCLIDES				
124092	PERCH	GAMMA	CO-60	1,0000E-02	7,0000E-03
103086	PERCH	GAMMA	CS-137	1,0000E-02	7,3000E-03
104088	HAKE	GAMMA	CS-137	1,0000E-02	8,7000E-03
105085	PERCH	GAMMA	CS-137	9,7000E-02	2,1340E-02
106087	SHRIMP	GAMMA	CS-137	1,3000E-02	7,8000E-03
113089	FLOUNDER	GAMMA	CS-137	5,0000E-02	1,8500E-02
113089	HAKE	GAMMA	CS-137	1,2000E-02	1,0320E-02
113089	PERCH	GAMMA	CS-137	7,0000E-02	1,8900E-02
115090	FLOUNDER	GAMMA	CS-137	1,6000E-02	1,4720E-02
103086	FLOUNDER	PU	PU-238	5,1580E-04	3,9320E-04
103086	HAKE	PU	PU-238	6,3230E-04	7,0750E-04
103086	HAKE	PU	PU-238	-1,1130E-04	2,2690E-04
103086	PERCH	PU	PU-238	6,9340E-04	5,3110E-04
104088	FLOUNDER	PU	PU-238	6,5940E-05	2,0850E-04
104088	HAKE	PU	PU-238	4,6870E-04	3,0410E-04
104088	PERCH	PU	PU-238	2,1920E-04	3,1020E-04
105085	FLOUNDER	PU	PU-238	5,4910E-05	1,8940E-04
105085	SHRIMP	PU	PU-238	1,3050E-03	1,0720E-03
105085	SHRIMP	PU	PU-238	9,4080E-04	2,9790E-03
106087	FLOUNDER	PU	PU-238	2,6610E-04	2,0490E-04
106087	HAKE	PU	PU-238	2,1530E-04	2,2480E-03
106087	HAKE	PU	PU-238	4,8790E-05	1,8540E-04
106087	SHRIMP	PU	PU-238	-5,9470E-04	6,1100E-04
113089	CRABS	PU	PU-238	2,1160E-03	1,3770E-03
115090	CRABS	PU	PU-238	-3,5810E-04	9,4640E-04
115090	FLOUNDER	PU	PU-238	3,5600E-04	2,7680E-04
115090	HAKE	PU	PU-238	9,6820E-05	1,9270E-04
115090	PERCH	PU	PU-238	4,7340E-04	4,2960E-04
115090	SHRIMP	PU	PU-238	6,3130E-04	1,0470E-03
118091	FLOUNDER	PU	PU-238	1,6390E-04	5,3920E-04
118091	PERCH	PU	PU-238	3,4040E-04	3,7510E-04
118091	PERCH	PU	PU-238	-3,9580E-04	1,1290E-03
120094	FLOUNDER	PU	PU-238	3,9280E-04	3,6100E-04
122093	FLOUNDER	PU	PU-238	4,3490E-05	1,5510E-04
122093	HAKE	PU	PU-238	3,0100E-04	4,6740E-04
124092	COD	PU	PU-238	-7,8230E-05	2,0980E-04
124092	PERCH	PU	PU-238	6,2440E-04	8,5570E-04
124092	SHRIMP	PU	PU-238	4,2900E-04	4,9170E-04
124092	SHRIMP	PU	PU-238	5,2290E-05	8,7630E-04
103086	FLOUNDER	PU	PU-239	1,2610E-05	1,2380E-04
103086	HAKE	PU	PU-239	9,1310E-05	1,7520E-04
103086	HAKE	PU	PU-239	-1,1920E-04	2,5330E-04
103086	PERCH	PU	PU-239	1,6750E-04	2,1800E-04
104088	FLOUNDER	PU	PU-239	-3,7390E-05	7,4910E-05
104088	HAKE	PU	PU-239	1,5180E-04	1,4970E-04
104088	PERCH	PU	PU-239	7.3700E-05	1,1860E-04

105085	FLOUNDER	PU	PU-239	8,5720E-06	3,4330E-05
105085	SHRIMP	PU	PU-239	1,7130E-04	2,9080E-04
105085	SHRIMP	PU	PU-239	9,5420E-04	1,2310E-03
106087	FLOUNDER	PU	PU-239	-3,1260E-05	6,2620E-05
106087	HAKE	PU	PU-239	4,0830E-05	8,1630E-05
106087	HAKE	PU	PU-239	-2,6310E-04	6,1850E-04
106087	SHRIMP	PU	PU-239	1,3020E-04	2,4610E-04
113089	CRABS	PU	PU-239	-9,9710E-05	9,0110E-04
115090	CRABS	PU	PU-239	1,2160E-04	4,7380E-04
115090	FLOUNDER	PU	PU-239	-4,3330E-06	1,1660E-04
115090	HAKE	PU	PU-239	4,9790E-05	7,5560E-05
115090	PERCH	PU	PU-239	0,0000E-01	0,0000E-01
115090	SHRIMP	PU	PU-239	-6,5300E-05	5,6360E-04
118091	FLOUNDER	PU	PU-239	1,8540E-04	3,2560E-04
118091	PERCH	PU	PU-239	-1,5380E-04	3,0880E-04
118091	PERCH	PU	PU-239	-5,2830E-05	1,0590E-04
120094	FLOUNDER	PU	PU-239	0,0000E-01	0,0000E-01
122093	FLOUNDER	PU	PU-239	-1,4060E-04	1,2740E-04
122093	HAKE	PU	PU-239	1,4710E-05	5,9500E-05
124092	COD	PU	PU-239	3,2330E-05	5,9160E-05
124092	PERCH	PU	PU-239	5,2470E-04	5,9910E-04
124092	SHRIMP	PU	PU-239	1,7620E-04	2,9700E-04
124092	SHRIMP	PU	PU-239	-4,8210E-05	2,5590E-04
103086	FLOUNDER	SR	SR-90	-6,8000E-04	3,7400E-03
103086	HAKE	SR	SR-90	-2,0000E-03	1,1100E-02
104088	FLOUNDER	SR	SR-90	-1,0000E-03	8,8300E-03
104088	HAKE	SR	SR-90	-2,3000E-03	1,3225E-02
104088	PERCH	SR	SR-90	-2,4000E-03	1,8240E-02
105085	FLOUNDER	SR	SR-90	-3,0000E-03	1,7760E-02
105085	SHRIMP	SR	SR-90	-3,0000E-03	1,2000E-02
106087	FLOUNDER	SR	SR-90	-1,0000E-03	9,0000E-03
106087	HAKE	SR	SR-90	-2,0000E-03	1,2660E-02
106087	HAKE	SR	SR-90	-2,0000E-03	1,3620E-02
106087	SHRIMP	SR	SR-90	5,0000E-03	2,1350E-02
113089	CRABS	SR	SR-90	5,5000E-03	4,5650E-03
115090	HAKE	SR	SR-90	-1,0000E-03	3,1100E-03
115090	PERCH	SR	SR-90	2,0000E-03	1,7560E-02
115090	SHRIMP	SR	SR-90	-1,0000E-03	2,0000E-03
118091	FLOUNDER	SR	SR-90	2,0000E-04	2,6000E-03
118091	PERCH	SR	SR-90	-1,0000E-03	1,0670E-02
118091	SHRIMP	SR	SR-90	-1,0000E-03	5,5000E-03
118091	SHRIMP	SR	SR-90	-7,0000E-03	4,6900E-03
120094	FLOUNDER	SR	SR-90	6,0000E-04	3,1800E-03
122093	FLOUNDER	SR	SR-90	-2,5000E-03	5,0000E-03
122093	SHRIMP	SR	SR-90	2,2000E-03	7,7000E-03
124092	FLOUNDER	SR	SR-90	-7,0000E-04	2,4500E-03
124092	PERCH	SR	SR-90	-1,2000E-03	1,2960E-02
124092	SHRIMP	SR	SR-90	5,0000E-03	9,5500E-03
124092	SHRIMP	SR	SR-90	5,8000E-03	1,2586E-02

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103086	CRABS	GAMMA	BI-214	1,2000E-01	4,9200E-02
103086	FLOUNDER	GAMMA	BI-214	2,0000E-02	1,7000E-02
105085	PERCH	GAMMA	BI-214	1,6000E-01	4,3200E-02

106087	FLOUNDER	GAMMA	BI-214	1,3000E-01	2,9900E-02
113089	PERCH	GAMMA	BI-214	9,6000E-02	3,7440E-02
102084	HAKE	GAMMA	K-40	3,0000E+00	1,3800E+00
103086	CRABS	GAMMA	K-40	2,3000E+00	3,6800E-01
103086	FLOUNDER	GAMMA	K-40	3,1000E+00	2,1700E-01
103086	HAKE	GAMMA	K-40	3,7000E+00	5,1800E-01
103086	PERCH	GAMMA	K-40	3,5000E+00	2,4500E-01
104088	FLOUNDER	GAMMA	K-40	3,3000E+00	2,9700E-01
104088	HAKE	GAMMA	K-40	3,2000E+00	1,9200E-01
104088	HAKE	GAMMA	K-40	3,4000E+00	2,3800E-01
104088	PERCH	GAMMA	K-40	2,9000E+00	2,0300E-01
104088	SCALLOPS	GAMMA	K-40	4,1000E+00	8,6100E-01
104088	SHRIMP	GAMMA	K-40	2,4000E+00	2,4000E-01
105085	FLOUNDER	GAMMA	K-40	2,9000E+00	2,6100E-01
105085	PERCH	GAMMA	K-40	3,8000E+00	4,5600E-01
105085	SHRIMP	GAMMA	K-40	3,1000E+00	5,5800E-01
105085	SHRIMP	GAMMA	K-40	3,1000E+00	5,5800E-01
106087	FLOUNDER	GAMMA	K-40	3,3000E+00	2,9700E-01
106087	HAKE	GAMMA	K-40	3,5000E+00	5,2500E-01
106087	HAKE	GAMMA	K-40	4,0000E+00	5,6000E-01
106087	SHRIMP	GAMMA	K-40	3,2000E+00	2,8800E-01
113089	CRABS	GAMMA	K-40	2,1000E+00	2,9400E-01
113089	FLOUNDER	GAMMA	K-40	1,6000E+00	2,5600E-01
113089	HAKE	GAMMA	K-40	3,4000E+00	2,3800E-01
113089	PERCH	GAMMA	K-40	1,7000E+00	3,4000E-01
115090	CRABS	GAMMA	K-40	2,5000E+00	3,7500E-01
115090	FLOUNDER	GAMMA	K-40	3,0000E+00	4,5000E-01
115090	HAKE	GAMMA	K-40	3,2000E+00	1,9200E-01
115090	PERCH	GAMMA	K-40	3,0000E+00	2,1000E-01
115090	SHRIMP	GAMMA	K-40	2,4000E+00	2,1600E-01
118091	FLOUNDER	GAMMA	K-40	3,0000E+00	2,4000E-01
118091	HAKE	GAMMA	K-40	3,6000E+00	3,2400E-01
118091	PERCH	GAMMA	K-40	3,8000E+00	2,6600E-01
118091	SHRIMP	GAMMA	K-40	2,6000E+00	3,6400E-01
118091	SHRIMP	GAMMA	K-40	2,7000E+00	4,3200E-01
120094	FLOUNDER	GAMMA	K-40	3,5000E+00	2,8000E-01
122093	FLOUNDER	GAMMA	K-40	2,9000E+00	2,0300E-01
122093	HAKE	GAMMA	K-40	3,4000E+00	4,7600E-01
122093	PERCH	GAMMA	K-40	3,3000E+00	2,6400E-01
122093	PERCH	GAMMA	K-40	3,3000E+00	2,6400E-01
122093	SHRIMP	GAMMA	K-40	2,9000E+00	2,3200E-01
124092	FLOUNDER	GAMMA	K-40	2,7000E+00	2,1600E-01
124092	HAKE	GAMMA	K-40	3,6000E+00	3,6000E-01
124092	PERCH	GAMMA	K-40	3,1000E+00	2,1700E-01
124092	SHRIMP	GAMMA	K-40	2,9000E+00	2,3200E-01
124092	SHRIMP	GAMMA	K-40	2,9000E+00	2,6100E-01
103086	FLOUNDER	PB	PB-210	-8,7169E-02	1,2475E-01
103086	HAKE	PB	PB-210	1,1896E-01	2,2564E-01
103086	LOBSTER	PB	PB-210	8,2970E-02	1,6187E-01
103086	PERCH	PB	PB-210	5,0804E-02	4,6723E-01
104088	FLOUNDER	PB	PB-210	1,0381E-01	2,0387E-01
104088	HAKE	PB	PB-210	1,8080E-02	2,3182E-01
104088	HAKE	PB	PB-210	-2,7075E-02	1.1771E-01
104088	PERCH	PB	PB-210	7,0393E-03	2,2590E-01
105085	FLOUNDER	PB	PB-210	4,6546E-02	3,5282E-02

105085	SHRIMP	PB	PB-210	1,3217E-01	2,3897E-01
105085	SHRIMP	PB	PB-210	-3,9007E-03	3,0569E-01
106087	FLOUNDER	PB	PB-210	1,1134E-01	3,1619E-01
106087	HAKE	PB	PB-210	6,4818E-02	1,0026E-01
106087	HAKE	PB	PB-210	-3,3703E-02	9,7535E-02
106087	SHRIMP	PB	PB-210	1,0530E-01	2,9408E-01
113089	CRABS	PB	PB-210	1,3630E-02	2,6270E-01
113089	FLOUNDER	PB	PB-210	-3,5468E-01	4,5322E-01
113089	HAKE	PB	PB-210	-2,0552E-02	1,6843E-01
113089	PERCH	PB	PB-210	3,3837E-01	7,1884E-01
115090	CRABS	PB	PB-210	-1,4428E-01	1,5896E-01
115090	FLOUNDER	PB	PB-210	1,6211E-01	2,1884E-01
115090	HAKE	PB	PB-210	2,4993E-01	3,8614E-01
115090	PERCH	PB	PB-210	1,3151E-01	4,4824E-01
115090	SHRIMP	PB	PB-210	-7,7402E-02	2,2729E-01
118091	FLOUNDER	PB	PB-210	-2,4919E-02	1,3079E-01
118091	PERCH	PB	PB-210	2,0627E-01	2,3353E-01
118091	SHRIMP	PB	PB-210	1,3141E-01	1,9069E-01
118091	SHRIMP	PB	PB-210	-5,9271E-02	1,2072E-01
120094	FLOUNDER	PB	PB-210	-3,8094E-02	1,6077E-01
122093	FLOUNDER	PB	PB-210	-3,4908E-03	6,5134E-01
122093	HAKE	PB	PB-210	3,7866E-02	1,8115E-01
122093	SHRIMP	PB	PB-210	-8,0618E-02	1,4486E-01
124092	COD	PB	PB-210	-3,1262E-02	2,4124E-01
124092	FLOUNDER	PB	PB-210	-7,2676E-03	1,4301E-01
124092	PERCH	PB	PB-210	-8,1913E-02	2,1246E-01
124092	SHRIMP	PB	PB-210	1,0120E-01	4,3805E-01
124092	SHRIMP	PB	PB-210	-2,1536E-01	1,3464E-01
103086	CRABS	GAMMA	PB-214	1,0000E-01	4,1000E-02
103086	FLOUNDER	GAMMA	PB-214	2,4000E-02	1,8000E-02
105085	PERCH	GAMMA	PB-214	1,5000E-01	3,6000E-02
106087	FLOUNDER	GAMMA	PB-214	1,2000E-01	2,8800E-02
113089	PERCH	GAMMA	PB-214	8,5000E-02	3,0600E-02
103086	FLOUNDER	PO	PO-210	1,4232E-02	7,4471E-03
103086	HAKE	PO	PO-210	2,6779E-02	9,9384E-03
103086	LOBSTER	PO	PO-210	9,0554E-03	6,4684E-03
103086	PERCH	PO	PO-210	-3,4249E-04	3,1498E-03
104088	FLOUNDER	PO	PO-210	1,2524E-02	6,5510E-03
104088	HAKE	PO	PO-210	3,4902E-02	1,0618E-02
104088	HAKE	PO	PO-210	4,2406E-02	1,2425E-02
104088	PERCH	PO	PO-210	9,0298E-03	6,1349E-03
105085	FLOUNDER	PO	PO-210	1,7337E-02	8,2128E-03
105085	SHRIMP	PO	PO-210	2,1864E-01	4,0785E-02
105085	SHRIMP	PO	PO-210	2,2164E-01	5,4724E-02
106087	FLOUNDER	PO	PO-210	3,1374E-02	1,4762E-02
106087	HAKE	PO	PO-210	1,6950E-02	7,5580E-03
106087	HAKE	PO	PO-210	1,7015E-02	7,5525E-03
106087	SHRIMP	PO	PO-210	3,2603E-01	7,4843E-02
113089	CRABS	PO	PO-210	3,2692E-01	6,3642E-02
113089	FLOUNDER	PO	PO-210	9,6989E-03	8,1068E-03
113069	HAKE	PO	PO-210	3,1829E-02	1,1448E-02
113089	PERCH	PO	PO-210	1,3949E-03	6,3008E-03
115090	CRABS	PO	PO-210	3,6565E-01	7,5710E-02
115090	FLOUNDER	PO	PO-210	1,2448E-02	6,1510E-03
115090	HAKE	PO	PO-210	2,6650E-02	1,0988E-02

115090	PERCH	PO	PO-210	-1,7411E-04	3,3945E-03
115090	SHRIMP	PO	PO-210	1,8527E-01	5,9073E-02
118091	FLOUNDER	PO	PO-210	7,6875E-03	4,2497E-03
118091	PERCH	PO	PO-210	8,1780E-03	5,7644E-03
118091	SHRIMP	PO	PO-210	1,7557E-01	3,6395E-02
118091	SHRIMP	PO	PO-210	2,1697E-01	4,5341E-02
120094	FLOUNDER	PO	PO-210	1,0888E-02	6,7520E-03
122093	FLOUNDER	PO	PO-210	1,2453E-02	8,2732E-03
122093	HAKE	PO	PO-210	2,4910E-02	9,4662E-03
122093	SHRIMP	PO	PO-210	1,9498E-01	3,7051E-02
124092	COD	PO	PO-210	9,6170E-03	6,1122E-03
124092	FLOUNDER	PO	PO-210	1,2793E-02	6,5879E-03
124092	PERCH	PO	PO-210	1,1026E-02	7,0274E-03
124092	SHRIMP	PO	PO-210	2,3601E-01	4,9722E-02
124092	SHRIMP	PO	PO-210	2,4280E-01	6,6044E-02
103086	FLOUNDER	RA	RA-226	4,0000E-03	6,0000E-04
103086	HAKE	RA	RA-226	3,0000E-03	4,2000E-04
103086	LOBSTER	RA	RA-226	3,0000E-03	4,8000E-04
103086	PERCH	RA	RA-226	4,0000E-03	6,0000E-04
104088	FLOUNDER	RA	RA-226	6,0000E-03	6,0000E-04
104088	HAKE	RA	RA-226	1,0000E-02	7,0000E-04
104088	PERCH	RA	RA-226	1,0000E-02	9,0000E-04
105085	FLOUNDER	RA	RA-226	3,0000E-03	4,2000E-04
105085	SHRIMP	RA	RA-226	1,0000E-02	1,0000E-03
105085	SHRIMP	RA	RA-226	4,0000E-02	2,8000E-03
106087	FLOUNDER	RA	RA-226	5,0000E-03	5,5000E-04
106087	HAKE	RA	RA-226	3,0000E-03	4,2000E-04
106087	HAKE	RA	RA-226	5,0000E-03	5,5000E-04
106087	SHRIMP	RA	RA-226	1.5000E-02	1,5000E-03
113089	CRABS	RA	RA-226	4,0000E-02	2,8000E-03
115090	CRABS	RA	RA-226	2,0000E-03	2,0000E-04
115090	FLOUNDER	RA	RA-226	4,0000E-03	5,2000E-04
115090	HAKE	RA	RA-226	3,0000E-03	3,9000E-04
115090	PERCH	RA	RA-226	5,0000E-03	6,0000E-04
115090	SHRIMP	RA	RA-226	2,0000E-02	1,6000E-03
118091	FLOUNDER	RA	RA-226	5,0000E-03	5,0000E-04
118091	PERCH	RA	RA-226	5,0000E-03	6,5000E-04
118091	SHRIMP	RA	RA-226	3,0000E-02	2,4000E-03
118091	SHRIMP	RA	RA-226	3.0000E-02	2,4000E-03
120094	FLOUNDER	RA	RA-226	6,0000E-03	6,0000E-04
122093	FLOUNDER	RA	RA-226	5,0000E-03	6,0000E-04
122093	HAKE	RA	RA-226	8,0000E-03	6,4000E-04
122093	SHRIMP	RA	RA-226	2,0000E-02	2,0000E-03
124092	COD	RA	RA-226	2,0000E-03	3,2000E-04
124092	FLOUNDER	RA	RA-226	5,0000E-03	5,0000E-04
124092	PERCH	RA	RA-226	6,0000E-03	7,2000E-04
124092	SHRIMP	RA	RA-226	2,0000E-02	1.6000E-03
124092	SHRIMP	RA	RA-226	3,0000E-02	2.1000E-03
103086	FLOUNDER	TH	TH-227	1.4980E-04	2,9950E-04
103086	HAKE	TH	TH-227	2,1070E-04	2,9810E-04
103086	PERCH	TH	TH-227	7,6280E-04	6,0370E-04
104088	FLOUNDER	TH	TH-227	5,5860E-04	4,4800E-04
104088	HAKE	TH	TH-227	5,0300E-04	5,8150E-04
104088	PERCH	TH	TH-227	5,1680E-04	5,4520E-04
105085	FLOUNDER	TH	TH-227	2,1780E-04	3,0820E-04

105085	SHRIMP	TH	TH-227	1,3440E-03	1,0170E-03
105085	SHRIMP	TH	TH-227	4,6840E-03	2,6010E-03
106087	FLOUNDER	TH	TH-227	6,8680E-05	4,9530E-04
106087	SHRIMP	TH	TH-227	1,1430E-03	1,3730E-03
113089	CRABS	TH	TH-227	3,7220E-03	2,7470E-03
115090	CRABS	TH	TH-227	-1,2540E-03	1,8700E-03
115090	HAKE	TH	TH-227	4,3950E-04	3,8080E-04
115090	PERCH	TH	TH-227	-4,0280E-03	1,3960E-02
115090	PERCH	TH	TH-227	-8,7420E-05	3,0280E-04
115090	SHRIMP	TH	TH-227	2,8100E-03	1,6260E-03
118091	FLOUNDER	TH	TH-227	3,3980E-04	3,5970E-04
118091	PERCH	TH	TH-227	3,5480E-04	4,3470E-04
118091	SHRIMP	TH	TH-227	3,4090E-03	1,9510E-03
118091	SHRIMP	TH	TH-227	3,4140E-03	2,0720E-03
120094	FLOUNDER	TH	TH-227	6,7670E-04	4,9900E-04
122093	FLOUNDER	TH	TH-227	1,7420E-04	3,0730E-04
122093	HAKE	TH	TH-227	4,5030E-04	3,8620E-04
122093	SHRIMP	TH	TH-227	2,4330E-03	1,5410E-03
124092	COD	TH	TH-227	2,5110E-04	2,5120E-04
124092	FLOUNDER	TH	TH-227	6,7050E-04	5,8100E-04
124092	PERCH	TH	TH-227	6,8480E-04	4,8470E-04
124092	SHRIMP	TH	TH-227	1,5700E-03	1,0480E-03
124092	SHRIMP	TH	TH-227	4,2900E-03	1,7210E-03
103086	FLOUNDER	TH	TH-228	5,9650E-04	6,2910E-04
103086	HAKE	TH	TH-228	1,0230E-05	4,9210E-04
103086	PERCH	TH	TH-228	1,1620E-03	9,8450E-04
104088	FLOUNDER	TH	TH-228	1,9550E-03	7,6780E-04
104088	HAKE	TH	TH-228	1,0540E-03	1,3460E-03
104088	PERCH	TH	TH-228	4,1600E-03	1,2620E-03
105085	FLOUNDER	TH	TH-228	-2,1480E-04	5,9210E-04
105085	SHRIMP	TH	TH-228	2,4920E-02	4,8180E-03
105085	SHRIMP	TH	TH-228	5,8340E-03	2,2530E-03
106087	FLOUNDER	TH	TH-228	7,9790E-04	7,3450E-04
106087	SHRIMP	TH	TH-228	3,3400E-03	2,2430E-03
113089	CRABS	TH	TH-228	2,8930E-02	5,8200E-03
115090	CRABS	TH	TH-228	-3,1850E-04	4,1720E-03
115090	HAKE	TH	TH-228	3,6190E-04	5,0460E-04
115090	PERCH	TH	TH-228	-1,3550E-03	6,1380E-04
115090	PERCH	TH	TH-228	-6,2420E-02	2,8280E-02
115090	SHRIMP	TH	TH-228	4,9090E-03	2,4050E-03
118091	FLOUNDER	TH	TH-228	2,1040E-03	7,8020E-04
118091	PERCH	TH	TH-228	6,5930E-04	8,9850E-04
118091	SHRIMP	TH	TH-228	1,3500E-02	3,2730E-03
118091	SHRIMP	TH	TH-228	1,7330E-02	3,5800E-03
120094	FLOUNDER	TH	TH-228	3,1540E-03	9,1430E-04
122093	FLOUNDER	TH	TH-228	-4,0110E-04	5,2560E-04
122093	HAKE	TH	TH-228	6,6630E-04	6,3440E-04
122093	SHRIMP	TH	TH-228	9,8870E-03	3,0390E-03
124092	COD	TH	TH-228	5,5520E-04	7,7560E-04
124092	FLOUNDER	TH	TH-228	1,3180E-03	7,8150E-04
124092	PERCH	TH	TH-228	8,9480E-04	8,7450E-04
124092	SHRIMP	TH	TH-228	1,2710E-02	2,5800E-03
124092	SHRIMP	TH	TH-228	9,3170E-03	2,3770E-03
103086	FLOUNDER	TH	TH-230	2,5160E-04	2,5920E-04
103086	HAKE	TH	TH-230	2,5290E-04	2,5810E-04

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103086   PERCH          TH       TH-230    5,4920E-04  3,8890E-04
104088   FLOUNDER       TH       TH-230    2,7110E-03  5,8310E-04
104088   HAKE           TH       TH-230    3,1390E-03  1,0690E-03
104088   PERCH          TH       TH-230    5,6640E-03  1,1190E-03
105085   FLOUNDER       TH       TH-230   -2,3530E-04  2,9130E-04
105085   SHRIMP         TH       TH-230    3,6490E-02  5,1250E-03
105085   SHRIMP         TH       TH-230    4,5160E-03  1,3270E-03
106087   FLOUNDER       TH       TH-230    4,2860E-04  3,1660E-04
106087   SHRIMP         TH       TH-230    3,6220E-03  1,3060E-03
113089   CRABS          TH       TH-230    2,0250E-02  4,0820E-03
115090   CRABS          TH       TH-230    1.4040E-03  1,2060E-03
115090   HAKE           TH       TH-230    8,4380E-04  2,9940E-04
115090   PERCH          TH       TH-230    3,0940E-02  1,6450E-02
115090   PERCH          TH       TH-230    6,7140E-04  3,5710E-04
115090   SHRIMP         TH       TH-230    6,9700E-03  1,8180E-03
118091   FLOUNDER       TH       TH-230    1,7610E-03  4,8200E-04
118091   PERCH          TH       TH-230    1,4050E-03  5,2060E-04
118091   SHRIMP         TH       TH-230    1,5900E-02  2,7830E-03
118091   SHRIMP         TH       TH-230    1,8730E-02  3,0630E-03
120094   FLOUNDER       TH       TH-230    1,7320E-03  5,0180E-04
122093   FLOUNDER       TH       TH-230    5,5740E-04  2,6240E-04
122093   HAKE           TH       TH-230    5,2490E-04  3,2120E-04
122093   SHRIMP         TH       TH-230    1,1800E-02  2,5500E-03
124092   COD            TH       TH-230    1,2050E-03  4,0170E-04
124092   FLOUNDER       TH       TH-230    1,7700E-03  5,3630E-04
124092   PERCH          TH       TH-230    1,5200E-03  5,4080E-04
124092   SHRIMP         TH       TH-230    6,5070E-03  1,4770E-03
124092   SHRIMP         TH       TH-230    8,6250E-03  1,7190E-03
105085   PERCH          GAMMA    TH-232    8,8000E-02  6,3360E-02
103086   FLOUNDER       TH       TH-232    3,2350E-04  2,7850E-04
103086   HAKE           TH       TH-232    1.2640E-04  1,5180E-04
103086   PERCH          TH       TH-232    0,0000E-01  2,2420E-04
104088   FLOUNDER       TH       TH-232    1,7580E-03  4,6980E-04
104088   HAKE           TH       TH-232    1,6900E-03  8,1010E-04
104088   PERCH          TH       TH-232    5,3740E-03  1,0090E-03
105085   FLOUNDER       TH       TH-232    2,6140E-05  2,1560E-04
105085   SHRIMP         TH       TH-232    2,6290E-02  4,3390E-03
105085   SHRIMP         TH       TH-232    4,0550E-03  1,2590E-03
106087   FLOUNDER       TH       TH-232    9,8900E-05  1,4750E-04
106087   SHRIMP         TH       TH-232    2,7440E-03  1,1020E-03
113089   CRABS          TH       TH-232    2,7200E-02  4,7590E-03
115090   CRABS          TH       TH-232    0,0000E-01  0,0000E-01
115090   HAKE           TH       TH-232    5,8010E-04  2,4800E-04
115090   PERCH          TH       TH-232    2,0980E-04  1,8780E-04
115090   PERCH          TH       TH-232    9,6680E-03  8,6560E-03
115090   SHRIMP         TH       TH-232    6,7450E-03  1,7600E-03
118091   FLOUNDER       TH       TH-232    1,1090E-03  3,8170E-04
118091   PERCH          TH       TH-232    8,0880E-04  3,9140E-04
118091   SHRIMP         TH       TH-232    1,6130E-02  2,8040E-03
118091   SHRIMP         TH       TH-232    1,8260E-02  2,9880E-03
120094   FLOUNDER       TH       TH-232    1,1910E-03  4,2800E-04
122093   FLOUNDER       TH       TH-232    4,4600E-04  2,2370E-04
122093   HAKE           TH       TH-232    5,5580E-04  2,7660E-04
122093   SHRIMP         TH       TH-232    1,0050E-02  2,2350E-03
124092   COD            TH       TH-232    3,3140E-04  2,6290E-04
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124092	FLOUNDER	TH	TH-232	8,8500E-04	4,1110E-04
124092	PERCH	TH	TH-232	9,4510E-04	4,1190E-04
124092	SHRIMP	TH	TH-232	4,4380E-03	1,2490E-03
124092	SHRIMP	TH	TH-232	6,2600E-03	1,4480E-03
103086	FLOUNDER	U	U-234	1,5790E-03	5,1460E-04
103086	HAKE	U	U-234	1,8420E-03	5,8770E-04
104088	FLOUNDER	U	U-234	1,9650E-03	7,3230E-04
104088	HAKE	U	U-234	4,9920E-03	9,4950E-04
104088	PERCH	U	U-234	6,8690E-03	1,6050E-03
105085	FLOUNDER	U	U-234	1,8090E-03	5,9790E-04
105085	SHRIMP	U	U-234	8,3570E-02	1,0880E-02
106087	FLOUNDER	U	U-234	2,1530E-03	6,8550E-04
106087	HAKE	U	U-234	1,4110E-03	5,1370E-04
106087	SHRIMP	U	U-234	1,2480E-02	2,7220E-03
113089	CRABS	U	U-234	2,9220E-02	5,8550E-03
115090	CRABS	U	U-234	1,9880E-02	5,1180E-03
115090	HAKE	U	U-234	2,4270E-03	7,2550E-04
115090	PERCH	U	U-234	3,8110E-03	1,2030E-03
118091	PERCH	U	U-234	2,4050E-02	8,4660E-03
120094	FLOUNDER	U	U-234	3,2620E-03	7,8170E-04
124092	COD	U	U-234	1,0960E-03	4,2870E-04
124092	PERCH	U	U-234	4,1780E-03	1,5120E-03
124092	SHRIMP	U	U-234	2,5500E-02	4,5740E-03
124092	SHRIMP	U	U-234	2,8890E-01	4,3040E-02
103086	FLOUNDER	U	U-235	1,2840E-04	1,6150E-04
103086	HAKE	U	U-235	3,6050E-04	2,9130E-04
104088	FLOUNDER	U	U-235	1,5610E-04	2,3940E-04
104088	HAKE	U	U-235	2,5770E-04	1,8000E-04
104088	PERCH	U	U-235	3,2560E-04	3,0790E-04
105085	FLOUNDER	U	U-235	7,9880E-05	1,1410E-04
105085	SHRIMP	U	U-235	2,8170E-03	1,2600E-03
106087	FLOUNDER	U	U-235	0,0000E-01	0,0000E-01
106087	HAKE	U	U-235	4,1610E-05	1,4450E-04
106087	SHRIMP	U	U-235	2,4420E-04	3,2510E-04
113089	CRABS	U	U-235	9,7690E-04	8,8620E-04
115090	CRABS	U	U-235	8,1200E-04	8,8150E-04
115090	HAKE	U	U-235	2,5280E-04	2,4630E-04
115090	PERCH	U	U-235	2,8910E-04	3,5330E-04
118091	PERCH	U	U-235	1,6670E-04	6,5560E-04
120094	FLOUNDER	U	U-235	2,4170E-04	2,0920E-04
124092	COD	U	U-235	2,4570E-05	1,1360E-04
124092	PERCH	U	U-235	2,0910E-04	3,1790E-04
124092	SHRIMP	U	U-235	1,5740E-02	7,8500E-03
124092	SHRIMP	U	U-235	5,9810E-04	5,7170E-04
103086	FLOUNDER	U	U-238	1,9540E-03	5,5870E-04
103086	HAKE	U	U-238	8,4110E-04	3,9420E-04
104088	FLOUNDER	U	U-238	2,5350E-03	8,3850E-04
104088	HAKE	U	U-238	4,7300E-03	9,1270E-04
104088	PERCH	U	U-238	5,3010E-03	1,3710E-03
105085	FLOUNDER	U	U-238	1,0770E-03	4,3350E-04
105085	SHRIMP	U	U-238	5,1640E-02	7,3920E-03
106087	FLOUNDER	U	U-238	1,2790E-03	5,1330E-04
106087	HAKE	U	U-238	1,1540E-03	4,5990E-04
106087	SHRIMP	U	U-238	7,8270E-03	2,0420E-03
113089	CRABS	U	U-238	3,4950E-02	6,6050E-03

115090	CRABS	U	U-238	1.9640E-02	4.8140E-03
115090	HAKE	U	U-238	3.1460E-03	8.1780E-04
115090	PERCH	U	U-238	3.3640E-03	1.0700E-03
118091	PERCH	U	U-238	9.0410E-03	5.2460E-03
120094	FLOUNDER	U	U-238	2.4510E-03	6.4690E-04
124092	COD	U	U-238	1.7740E-03	5.2950E-04
124092	PERCH	U	U-238	4.6180E-03	1.6000E-03
124092	SHRIMP	U	U-238	1.9360E-01	3.2750E-02
124092	SHRIMP	U	U-238	2.5230E-02	4.5410E-03

AREA 1 GROSS ALPHA

102084	HAKE	ALPHA	ALPHA	-5.0000E-02	1.7300E-01
103086	FLOUNDER	ALPHA	ALPHA	2.0000E-01	2.0400E-01
103086	HAKE	ALPHA	ALPHA	-4.0000E-02	2.1160E-01
103086	LOBSTER	ALPHA	ALPHA	5.0000E-02	2.5500E-01
103086	PERCH	ALPHA	ALPHA	-2.0000E-01	2.1000E-01
104088	FLOUNDER	ALPHA	ALPHA	-2.0000E-02	1.2000E-01
104088	HAKE	ALPHA	ALPHA	-1.0000E-02	1.6300E-02
104088	HAKE	ALPHA	ALPHA	-1.0000E-02	1.6300E-02
104088	PERCH	ALPHA	ALPHA	-1.0000E-02	2.9100E-02
104088	SHRIMP	ALPHA	ALPHA	2.0000E-01	2.8600E-01
105085	FLOUNDER	ALPHA	ALPHA	-2.0000E-02	1.3260E-01
105085	PERCH	ALPHA	ALPHA	0.0000E-01	0.0000E-01
105085	SHRIMP	ALPHA	ALPHA	-2.0000E-01	3.2800E-01
105085	SHRIMP	ALPHA	ALPHA	-4.0000E-01	2.5200E-01
106087	FLOUNDER	ALPHA	ALPHA	-1.0000E-01	1.5600E-01
106087	HAKE	ALPHA	ALPHA	2.0000E-02	1.5500E-01
106087	HAKE	ALPHA	ALPHA	-7.0000E-02	1.9250E-01
106087	SHRIMP	ALPHA	ALPHA	2.0000E-02	1.8340E-01
113089	CRABS	ALPHA	ALPHA	-1.0000E-01	2.5800E-01
113089	FLOUNDER	ALPHA	ALPHA	-2.0000E-01	1.7200E-01
113089	HAKE	ALPHA	ALPHA	-4.0000E-02	1.4960E-01
113089	PERCH	ALPHA	ALPHA	-3.0000E-01	2.4000E-01
115090	CRABS	ALPHA	ALPHA	-1.0000E-01	2.5800E-01
115090	FLOUNDER	ALPHA	ALPHA	2.0000E-01	2.3400E-01
115090	HAKE	ALPHA	ALPHA	0.0000E-01	0.0000E-01
115090	PERCH	ALPHA	ALPHA	-2.0000E-02	1.6500E-01
115090	SHRIMP	ALPHA	ALPHA	-2.0000E-02	1.3260E-01
118091	FLOUNDER	ALPHA	ALPHA	-1.0000E-01	1.4400E-01
118091	HAKE	ALPHA	ALPHA	-4.0000E-02	1.6960E-01
118091	PERCH	ALPHA	ALPHA	-2.0000E-02	1.4240E-01
118091	SHRIMP	ALPHA	ALPHA	2.0000E-01	3.4800E-01
118091	SHRIMP	ALPHA	ALPHA	-2.0000E-02	2.1540E-01
120094	FLOUNDER	ALPHA	ALPHA	0.0000E-01	0.0000E-01
122093	FLOUNDER	ALPHA	ALPHA	-4.0000E-02	1.2640E-01
122093	HAKE	ALPHA	ALPHA	-1.0000E-01	1.2200E-01
122093	PERCH	ALPHA	ALPHA	2.0000E-02	1.5500E-01
122093	PERCH	ALPHA	ALPHA	4.0000E-02	2.0400E-01
122093	SHRIMP	ALPHA	ALPHA	3.0000E-01	4.1700E-01
124092	COD	ALPHA	ALPHA	2.0000E-02	1.2000E-01
124092	FLOUNDER	ALPHA	ALPHA	-4.0000E-02	1.4960E-01
124092	HAKE	ALPHA	ALPHA	-9.0000E-02	1.8000E-01
124092	PERCH	ALPHA	ALPHA	-1.0000E-01	2.5800E-01
124092	SHRIMP	ALPHA	ALPHA	-1.0000E-01	2.2100E-01

124092	SHRIMP	ALPHA	ALPHA	-2,0000E-02	1,3260E-01

AREA 1 GROSS BETA

102084	HAKE	BETA	BETA	4,4000E+00	3,0800E-01
103086	FLOUNDER	BETA	BETA	4,1000E+00	2,8700E-01
103086	HAKE	BETA	BETA	3,6000E+00	2,8800E-01
103086	LOBSTER	BETA	BETA	3,1000E+00	2,7900E-01
103086	PERCH	BETA	BETA	4,5000E+00	3,6000E-01
104088	FLOUNDER	BETA	BETA	3,5000E+00	2,8000E-01
104088	HAKE	BETA	BETA	4,0000E+00	8,0000E-02
104088	HAKE	BETA	BETA	4,1000E+00	8,2000E-02
104088	PERCH	BETA	BETA	4,2000E+00	8,4000E-02
104088	SHRIMP	BETA	BETA	2,3000E+00	2,5300E-01
105085	FLOUNDER	BETA	BETA	3,8000E+00	3,0400E-01
105085	PERCH	BETA	BETA	4,9000E+00	3,4300E-01
105085	SHRIMP	BETA	BETA	3,1000E+00	3,1000E-01
105085	SHRIMP	BETA	BETA	3,4000E+00	3,4000E-01
106087	FLOUNDER	BETA	BETA	4,0000E+00	3,2000E-01
106087	HAKE	BETA	BETA	4,3000E+00	3,0100E-01
106087	HAKE	BETA	BETA	4,9000E+00	2,9400E-01
106087	SHRIMP	BETA	BETA	3,3000E+00	2,9700E-01
113089	CRABS	BETA	BETA	3,3000E+00	3,3000E-01
113089	FLOUNDER	BETA	BETA	4,5000E+00	3,1500E-01
113089	HAKE	BETA	BETA	3,2000E+00	2,5600E-01
113089	PERCH	BETA	BETA	4,6000E+00	3,6800E-01
115090	CRABS	BETA	BETA	2,5000E+00	3,2500E-01
115090	FLOUNDER	BETA	BETA	3,5000E+00	2,8000E-01
115090	HAKE	BETA	BETA	3,7000E+00	2,5900E-01
115090	PERCH	BETA	BETA	3,5000E+00	3,1500E-01
115090	SHRIMP	BETA	BETA	3,5000E+00	3,1500E-01
118091	FLOUNDER	BETA	BETA	3,7000E+00	2,9600E-01
118091	HAKE	BETA	BETA	1,7000E+01	1,3600E+00
118091	HAKE	BETA	BETA	3,1000E+00	2,4800E-01
118091	PERCH	BETA	BETA	4,3000E+00	3,4400E-01
118091	SHRIMP	BETA	BETA	3,1000E+00	2,7900E-01
118091	SHRIMP	BETA	BETA	3,1000E+00	2,7900E-01
120094	FLOUNDER	BETA	BETA	3,8000E+00	3,0400E-01
122093	FLOUNDER	BETA	BETA	4,0000E+00	3,2000E-01
122093	HAKE	BETA	BETA	4,0000E+00	2,8000E-01
122093	PERCH	BETA	BETA	4,7000E+00	3,2900E-01
122093	PERCH	BETA	BETA	5,0000E+00	3,5000E-01
122093	SHRIMP	BETA	BETA	3,2000E+00	3,2000E-01
124092	COD	BETA	BETA	4,1000E+00	2,8700E-01
124092	FLOUNDER	BETA	BETA	3,3000E+00	2,6400E-01
124092	HAKE	BETA	BETA	4,3000E+00	3,0100E-01
124092	PERCH	BETA	BETA	3,4000E+00	2,7200E-01
124092	SHRIMP	BETA	BETA	3,8000E+00	3,0400E-01
124092	SHRIMP	BETA	BETA	3,9000E+00	3,1200E-01

AREA 2 MAN-MADE NUCLIDES

212144	SHRIMP	GAMMA	CO-60	1,0000E-02	6,4000E-03
212144	SHRIMP	GAMMA	CO-60	1,7000E-02	8,3300E-03
207145	COD	PU	PU-238	2,4480E-04	3,3990E-04

212144	SHRIMP	PU	PU-238	6,5850E-03	6,6970E-03
212144	SHRIMP	PU	PU-238	7.4010E-04	6,7970E-04
207145	COD	PU	PU-239	5,8200E-05	3,1990E-04
212144	SHRIMP	PU	PU-239	2,1590E-03	2,5960E-03
212144	SHRIMP	PU	PU-239	3,8320E-04	4,2530E-04
207145	COD	SR	SR-90	7.0000E-04	1,8000E-03
212144	SHRIMP	SR	SR-90	1,9000E-03	3,8000E-03
212144	SHRIMP	SR	SR-90	3,7000E-03	3,2560E-03

AREA 2 NATURAL NUCLIDES

206146	FLOUNDER	GAMMA	K-40	5,1000E+00	6,6300E-01
207145	COD	GAMMA	K-40	3,2000E+00	1,9200E-01
207145	EEL POUT	GAMMA	K-40	3,9000E+00	2,7300E-01
207145	FLOUNDER	GAMMA	K-40	3,3000E+00	2,3100E-01
207145	LOBSTER	GAMMA	K-40	3,0000E+00	2,4000E-01
207245	HAKE	GAMMA	K-40	3,4000E+00	2,0400E-01
212144	EEL POUT	GAMMA	K-40	3,7000E+00	2,9600E-01
212144	FLOUNDER	GAMMA	K-40	3,4000E+00	2,7200E-01
212144	HAKE	GAMMA	K-40	3,6000E+00	2,8800E-01
212144	LOBSTER	GAMMA	K-40	2,0000E+00	2,8000E-01
212144	SHRIMP	GAMMA	K-40	2,5000E+00	2,0000E-01
212144	SHRIMP	GAMMA	K-40	2,7000E+00	2,1600E-01
207145	COD	PB	PB-210	-2,0172E-01	1,2758E-01
207145	EEL POUT	PB	PB-210	-2,3370E-01	2,9030E-01
207145	FLOUNDER	PB	PB-210	6,4830E-02	2,0500E-01
207245	HAKE	PB	PB-210	-1,1100E-01	1,0549E-01
212144	LOBSTER	PB	PB-210	7,5002E-02	9,5278E-02
212144	SHRIMP	PB	PB-210	8,5430E-02	1,0900E+00
212144	SHRIMP	PB	PB-210	-2,7860E-01	2,7180E-01
207145	COD	PO	PO-210	5,3807E-02	1,5063E-02
207145	EEL POUT	PO	PO-210	6,8870E-02	3,7920E-02
207145	FLOUNDER	PO	PO-210	1,7270E-02	8,9590E-03
207245	HAKE	PO	PO-210	2,9852E-02	9,6256E-03
212144	LOBSTER	PO	PO-210	3,3788E-02	8,7684E-03
212144	SHRIMP	PO	PO-210	4,3350E-01	1,2570E-01
212144	SHRIMP	PO	PO-210	4,6170E-01	1,2750E-01
207145	COD	RA	RA-226	2,0000E-03	3,4000E-04
207145	EEL POUT	RA	RA-226	3,0000E-03	4,5000E-04
207145	FLOUNDER	RA	RA-226	4,0000E-03	5,2000E-04
207245	HAKE	RA	RA-226	3,0000E-03	4,5000E-04
212144	LOBSTER	RA	RA-226	6,0000E-03	8,4000E-04
212144	SHRIMP	RA	RA-226	2,0000E-02	1,4000E-03
212144	SHRIMP	RA	RA-226	2,0000E-02	1,8000E-03
207145	COD	TH	TH-227	5,3660E-05	1,8590E-04
207145	EEL POUT	TH	TH-227	1,2760E-04	2,5530E-04
207145	FLOUNDER	TH	TH-227	7,4650E-05	3,3390E-04
207245	HAKE	TH	TH-227	4,9250E-04	4,2420E-04
212144	LOBSTER	TH	TH-227	1,5260E-03	9,2170E-04
212144	SHRIMP	TH	TH-227	1,8920E-03	1,1980E-03
212144	SHRIMP	TH	TH-227	3,5160E-03	1,7790E-03
207145	COD	TH	TH-228	9,9600E-04	7,1950E-04
207145	EEL POUT	TH	TH-228	1,5120E-04	7,6780E-04
207145	FLOUNDER	TH	TH-228	1,0460E-03	9,6590E-04
207245	HAKE	TH	TH-228	1,8240E-04	6,7290E-04

212144	LOBSTER	TH	TH-228	2,3050E-03	1,8470E-03
212144	SHRIMP	TH	TH-228	6,4160E-03	2,2010E-03
212144	SHRIMP	TH	TH-228	7,9110E-03	2,3890E-03
207145	COD	TH	TH-230	2,3180E-04	2,6780E-04
207145	EEL POUT	TH	TH-230	3,9820E-04	2,6740E-04
207145	FLOUNDER	TH	TH-230	6,8080E-04	3,4440E-04
207245	HAKE	TH	TH-230	4,4650E-04	2,7340E-04
212144	LOBSTER	TH	TH-230	2,8630E-03	9,1870E-04
212144	SHRIMP	TH	TH-230	7,6390E-03	1,7050E-03
212144	SHRIMP	TH	TH-230	8,8110E-03	1,8120E-03
207145	COD	TH	TH-232	5,1510E-05	1,6290E-04
207145	EEL POUT	TH	TH-232	4,5950E-04	2,5300E-04
207145	FLOUNDER	TH	TH-232	4,6580E-04	3,1270E-04
207245	HAKE	TH	TH-232	6,3040E-04	2,9800E-04
212144	LOBSTER	TH	TH-232	2,3300E-03	7,9220E-04
212144	SHRIMP	TH	TH-232	7,4620E-03	1,6470E-03
212144	SHRIMP	TH	TH-232	9,4470E-03	1,8960E-03
212144	SHRIMP	U	U-234	1,1840E-02	2,5910E-03
212144	SHRIMP	U	U-234	9,8300E-03	2,3630E-03
212144	SHRIMP	U	U-235	3,3930E-04	4,9670E-04
212144	SHRIMP	U	U-235	7,2780E-04	6,2940E-04
212144	SHRIMP	U	U-238	7,7500E-03	2,0470E-03
212144	SHRIMP	U	U-238	8,7540E-03	2,1490E-03

AREA 2 GROSS ALPHA

206146	FLOUNDER	ALPHA	ALPHA	-2,0000E-01	1,8800E-01
207145	COD	ALPHA	ALPHA	2,0000E-02	1,8320E-01
207145	EEL POUT	ALPHA	ALPHA	-2,0000E-02	1,3260E-01
207145	FLOUNDER	ALPHA	ALPHA	0,0000E-01	0,0000E-01
207145	LOBSTER	ALPHA	ALPHA	-2,0000E-02	1,0580E-01
207245	HAKE	ALPHA	ALPHA	2,0000E-02	1,7440E-01
212144	EEL POUT	ALPHA	ALPHA	-1,0000E-01	1,4900E-01
212144	FLOUNDER	ALPHA	ALPHA	0,0000E-01	0,0000E-01
212144	HAKE	ALPHA	ALPHA	-1,0000E-01	2,5800E-01
212144	LOBSTER	ALPHA	ALPHA	0,0000E-01	0,0000E-01
212144	SHRIMP	ALPHA	ALPHA	-1,0000E-01	2,5800E-01
212144	SHRIMP	ALPHA	ALPHA	-4,0000E-02	1,6000E-01

AREA 2 GROSS BETA

206146	FLOUNDER	BETA	BETA	4,5000E+00	3,1500E-01
207145	COD	BETA	BETA	3,8000E+00	3,0400E-01
207145	EEL POUT	BETA	BETA	3,6000E+00	2,8800E-01
207145	FLOUNDER	BETA	BETA	3,8000E+00	3,0400E-01
207145	LOBSTER	BETA	BETA	2,3000E+00	2,3000E-01
207245	HAKE	BETA	BETA	4,1000E+00	2,8700E-01
212144	EEL POUT	BETA	BETA	4,0000E+00	3,2000E-01
212144	FLOUNDER	BETA	BETA	4,4000E+00	3,0800E-01
212144	HAKE	BETA	BETA	3,8000E+00	2,6600E-01
212144	LOBSTER	BETA	BETA	1,5000E+00	1,3500E-01
212144	SHRIMP	BETA	BETA	2,2000E+00	2,4200E-01
212144	SHRIMP	BETA	BETA	2,9000E+00	2,9000E-01

AREA 3 MAN-MADE NUCLIDES

307108	COD	PU	PU-238	1,5890E-04	3,5310E-04
312107	FLOUNDER	PU	PU-238	1,8940E-04	1,6270E-04
307108	COD	PU	PU-239	7,3850E-04	4,0860E-04
312107	FLOUNDER	PU	PU-239	0,0000E-01	0,0000E-01
307108	COD	SR	SR-90	-3,0000E-05	9,0000E-05
312107	FLOUNDER	SR	SR-90	-5,0000E-04	5,1650E-03

AREA 3 NATURAL NUCLIDES

303109	HAKE	GAMMA	K-40	3,8000E+00	4,9400E-01
307108	COD	GAMMA	K-40	3,5000E+00	4,9000E-01
307108	EEL POUT	GAMMA	K-40	3,4000E+00	4,0800E-01
307108	FLOUNDER	GAMMA	K-40	3,1000E+00	2,1700E-01
307108	HAKE	GAMMA	K-40	3,8000E+00	3,0400E-01
307108	SHRIMP	GAMMA	K-40	2,7000E+00	2,7000E-01
312107	FLOUNDER	GAMMA	K-40	2,8000E+00	2,5200E-01
312107	PERCH	GAMMA	K-40	3,1000E+00	2,1700E-01
307108	COD	PB	PB-210	1,4660E-01	4,2200E-01
307108	EEL POUT	PB	PB-210	2,6510E-01	2,2080E+00
307108	HAKE	PB	PB-210	-3,4910E-02	4,7480E-01
307108	SHRIMP	PB	PB-210	2,1316E-01	1,9962E-01
312107	FLOUNDER	PB	PB-210	2,8740E-01	6,2200E-01
312107	PERCH	PB	PB-210	-3,9407E-02	1,6807E-01
307108	COD	PO	PO-210	1,8210E-02	1,2680E-02
307108	EEL POUT	PO	PO-210	6,8820E-03	1,6430E-02
307108	HAKE	PO	PO-210	2,4030E-04	3,2690E-03
307108	SHRIMP	PO	PO-210	1,6747E-01	3,2161E-02
312107	FLOUNDER	PO	PO-210	3,2090E-02	1,3850E-02
312107	PERCH	PO	PO-210	5,4938E-03	3,9421E-03
307108	COD	RA	RA-226	3,0000E-03	4,8000E-04
307108	EEL POUT	RA	RA-226	1,0000E-03	2,0000E-04
307108	HAKE	RA	RA-226	2,0000E-03	3,4000E-04
307108	SHRIMP	RA	RA-226	1,0000E-02	9,0000E-04
312107	FLOUNDER	RA	RA-226	4,0000E-03	5,2000E-04
312107	PERCH	RA	RA-226	3,0000E-03	6,0000E-04
307108	COD	TH	TH-227	8,3500E-04	4,6400E-04
307108	EEL POUT	TH	TH-227	2,6130E-04	2,7670E-04
307108	HAKE	TH	TH-227	-4,1160E-04	4,3590E-04
307108	SHRIMP	TH	TH-227	1,0030E-03	1,0570E-03
312107	FLOUNDER	TH	TH-227	1,3330E-04	4,2160E-04
307108	COD	TH	TH-228	7,1350E-04	6,2960E-04
307108	EEL POUT	TH	TH-228	1,2890E-04	6,4650E-04
307108	HAKE	TH	TH-228	1,3910E-04	8,2480E-04
307108	SHRIMP	TH	TH-228	3,7180E-03	2,3270E-03
312107	FLOUNDER	TH	TH-228	1,2530E-03	8,2140E-04
307108	COD	TH	TH-230	3,3910E-04	2,5450E-04
307108	EEL POUT	TH	TH-230	6,2710E-04	2,5180E-04
307108	HAKE	TH	TH-230	7,1130E-04	3,7170E-04
307108	SHRIMP	TH	TH-230	3,4490E-03	1,1290E-03
312107	FLOUNDER	TH	TH-230	1,5680E-03	4,7280E-04
307108	COD	TH	TH-232	2,7750E-04	1,8520E-04
307108	EEL POUT	TH	TH-232	5,2670E-04	2,3060E-04

307108	HAKE	TH	TH-232	2.7660E-04	2.0940E-04
307108	SHRIMP	TH	TH-232	3.6090E-03	1.1070E-03
312107	FLOUNDER	TH	TH-232	1.6320E-03	4.7340E-04
307108	COD	U	U-234	8.4310E-04	4.8670E-04
312107	FLOUNDER	U	U-234	1.0680E-03	3.9580E-04
307108	COD	U	U-235	1.7590E-04	2.0410E-04
312107	FLOUNDER	U	U-235	7.9120E-06	3.2760E-05
307108	COD	U	U-238	1.2500E-03	6.1190E-04
312107	FLOUNDER	U	U-238	4.6140E-04	2.7190E-04

AREA 3 GROSS ALPHA

303109	HAKE	ALPHA	ALPHA	-7.0000E-01	5.1800E-01
307108	COD	ALPHA	ALPHA	-4.0000E-02	1.2640E-01
307108	EEL POUT	ALPHA	ALPHA	-4.0000E-02	1.2640E-01
307108	FLOUNDER	ALPHA	ALPHA	-2.0000E-01	1.6000E-01
307108	HAKE	ALPHA	ALPHA	2.0000E-02	1.3260E-01
307108	SHRIMP	ALPHA	ALPHA	3.0000E-01	2.6400E-01
312107	FLOUNDER	ALPHA	ALPHA	0.0000E-01	0.0000E-01
312107	PERCH	ALPHA	ALPHA	-4.0000E-02	1.2640E-01

AREA 3 GROSS BETA

303109	HAKE	BETA	BETA	1.4900E+01	1.0430E+00
307108	COD	BETA	BETA	4.4000E+00	3.0800E-01
307108	EEL POUT	BETA	BETA	4.0000E+00	3.2000E-01
307108	FLOUNDER	BETA	BETA	4.3000E+00	3.0100E-01
307108	HAKE	BETA	BETA	3.8000E+00	2.6600E-01
307108	SHRIMP	BETA	BETA	2.8000E+00	2.2400E-01
312107	FLOUNDER	BETA	BETA	3.9000E+00	2.7300E-01
312107	PERCH	BETA	BETA	3.5000E+00	2.8000E-01

AREA 4 MAN-MADE NUCLIDES

403004	SCALLOPS	GAMMA	CO-60	2.0000E-02	1.0200E-02
404010	SHRIMP	GAMMA	CS-137	1.6000E-02	1.7440E-02
401003	CRABS	PU	PU-238	6.9730E-04	6.0180E-04
401003	FLOUNDER	PU	PU-238	2.1500E-04	2.4910E-04
401003	HAKE	PU	PU-238	1.7710E-04	1.8750E-04
401003	SHRIMP	PU	PU-238	4.3240E-04	6.9850E-04
401003	SHRIMP	PU	PU-238	9.2300E-04	1.0980E-03
403004	FLOUNDER	PU	PU-238	2.2450E-04	3.2050E-04
403004	HAKE	PU	PU-238	2.3640E-04	1.8220E-04
404010	FLOUNDER	PU	PU-238	2.1030E-03	4.3440E-03
404010	HAKE	PU	PU-238	6.8740E-04	4.2550E-04
404010	SHRIMP	PU	PU-238	2.0420E-03	1.2780E-03
408005	HAKE	PU	PU-238	3.5380E-04	2.8790E-04
408005	HAKE	PU	PU-238	7.2320E-05	1.0410E-04
408005	OCTOPOD	PU	PU-238	6.2170E-04	5.5040E-04
408005	SCALLOPS	PU	PU-238	6.4990E-04	1.0590E-03
408005	SHRIMP	PU	PU-238	1.2980E-03	8.0280E-04
410006	FLOUNDER	PU	PU-238	9.9800E-05	2.7580E-04
410006	HAKE	PU	PU-238	3.5150E-04	3.5400E-04
401003	CRABS	PU	PU-239	1.7310E-03	1.0880E-03
401003	FLOUNDER	PU	PU-239	5.1000E-05	9.1280E-05

401003	HAKE	PU	PU-239	8,4640E-05	1,0030E-04
401003	SHRIMP	PU	PU-239	7,3080E-04	7,1700E-04
401003	SHRIMP	PU	PU-239	8,5250E-05	4,6340E-04
403004	FLOUNDER	PU	PU-239	5,9560E-05	1,0280E-04
403004	HAKE	PU	PU-239	8,7710E-06	1,0320E-04
404010	FLOUNDER	PU	PU-239	1,3110E-04	1,9180E-03
404010	HAKE	PU	PU-239	3,3790E-04	2,7100E-04
404010	SHRIMP	PU	PU-239	1,5490E-04	6,2310E-04
408005	HAKE	PU	PU-239	8,6320E-05	1,1380E-04
408005	HAKE	PU	PU-239	-2,4850E-05	1,4530E-04
408005	OCTOPOD	PU	PU-239	3,4840E-04	4,6110E-04
408005	SCALLOPS	PU	PU-239	3,2220E-04	8,1800E-04
408005	SHRIMP	PU	PU-239	3,0090E-04	3,8100E-04
410006	FLOUNDER	PU	PU-239	1,1770E-04	1,5190E-04
410006	HAKE	PU	PU-239	6,5770E-05	1,1290E-04
401003	FLOUNDER	SR	SR-90	-4,0000E-03	3,7000E-03
401003	HAKE	SR	SR-90	-4,0000E-03	4,8800E-03
401003	SHRIMP	SR	SR-90	1,1000E-03	5,0000E-04
401003	SHRIMP	SR	SR-90	1,1000E-03	9,1000E-03
403004	FLOUNDER	SR	SR-90	-5,4000E-03	1,3000E-03
403004	HAKE	SR	SR-90	4,8000E-04	1,2900E-03
403004	SHRIMP	SR	SR-90	-4,2000E-03	7,1000E-03
404010	HAKE	SR	SR-90	-6,1000E-03	6,0000E-04
404010	SHRIMP	SR	SR-90	-3,0000E-03	6,6000E-03
408005	HAKE	SR	SR-90	3,0000E-03	8,0000E-04
408005	SHRIMP	SR	SR-90	-1,5000E-03	1,5000E-03
410006	FLOUNDER	SR	SR-90	7,5000E-04	9,4000E-04
410006	HAKE	SR	SR-90	-5,0000E-04	6,7000E-04
410006	SHRIMP	SR	SR-90	2,9000E-03	8,0000E-03

AREA 4 NATURAL NUCLIDES

401003	CRABS	GAMMA	K-40	3,0000E+00	3,9000E-01
401003	FLOUNDER	GAMMA	K-40	3,4000E+00	2,7200E-01
401003	HAKE	GAMMA	K-40	3,2000E+00	4,1600E-01
401003	OCTOPOD	GAMMA	K-40	2,3000E+00	2,9900E-01
401003	SHRIMP	GAMMA	K-40	2,8000E+00	3,0800E-01
401003	SHRIMP	GAMMA	K-40	2,9000E+00	3,1900E-01
403004	FLOUNDER	GAMMA	K-40	4,7000E+00	5,1700E-01
403004	HAKE	GAMMA	K-40	3,2000E+00	2,8800E-01
403004	SCALLOPS	GAMMA	K-40	2,7000E+00	2,7000E-01
403004	SHRIMP	GAMMA	K-40	3,3000E+00	5,6100E-01
404010	CRABS	GAMMA	K-40	1,6000E+00	1,7600E-01
404010	FLOUNDER	GAMMA	K-40	1,9000E+00	7,4100E-01
404010	HAKE	GAMMA	K-40	3,5000E+00	4,9000E-01
404010	OCTOPOD	GAMMA	K-40	2,7000E+00	8,3700E-01
404010	SHRIMP	GAMMA	K-40	3,0000E+00	4,8000E-01
408005	FLOUNDER	GAMMA	K-40	3,1000E+00	2,7900E-01
408005	HAKE	GAMMA	K-40	3,0000E+00	2,7000E-01
408005	HAKE	GAMMA	K-40	3,0000E+00	2,7000E-01
408005	OCTOPOD	GAMMA	K-40	2,8000E+00	3,6400E-01
408005	SCALLOPS	GAMMA	K-40	3,1000E+00	4,6500E-01
408005	SHRIMP	GAMMA	K-40	3,2000E+00	3,5200E-01
410006	FLOUNDER	GAMMA	K-40	3,2000E+00	2,8800E-01
410006	HAKE	GAMMA	K-40	2,9000E+00	4,6400E-01

410006	OCTOPOD	GAMMA	K-40	1,5000E+00	6,3000E-01
410006	SCALLOPS	GAMMA	K-40	2,1000E+00	7,7700E-01
410006	SHRIMP	GAMMA	K-40	2,7000E+00	1,2690E+00
401003	CRABS	PB	PB-210	2,6852E-01	2,1684E-01
401003	FLOUNDER	PB	PB-210	1,2993E-01	1,1936E+00
401003	HAKE	PB	PB-210	-6,3200E-02	9,9380E-01
401003	OCTOPOD	PB	PB-210	1,0249E-01	1,8020E-01
401003	SHRIMP	PB	PB-210	-3,9004E-02	2,6445E-01
401003	SHRIMP	PB	PB-210	-7,8922E-02	1,9517E-01
403004	FLOUNDER	PB	PB-210	3,1936E-02	3,0798E-01
403004	HAKE	PB	PB-210	8,0046E-02	1,9172E-01
403004	OCTOPOD	PB	PB-210	-1,4857E-02	9,3387E-02
403004	SCALLOPS	PB	PB-210	1,0575E-01	1,9956E-01
404010	CRABS	PB	PB-210	1,4204E-01	3,1183E-01
404010	FLOUNDER	PB	PB-210	5,1929E-04	1,9274E-01
404010	HAKE	PB	PB-210	7,8710E-02	1,7039E-01
404010	OCTOPOD	PB	PB-210	-9,7509E-02	1,8988E-01
404010	SCALLOPS	PB	PB-210	1,0080E-01	1,5322E-01
404010	SHRIMP	PB	PB-210	1,4260E-01	3,3040E-01
408005	HAKE	PB	PB-210	4,6089E-02	1,4444E-01
408005	HAKE	PB	PB-210	-3,3007E-02	1,2584E-01
408005	OCTOPOD	PB	PB-210	1,3403E-01	3,1657E-01
408005	SCALLOPS	PB	PB-210	-1,4445E-01	2,7535E-01
410006	FLOUNDER	PB	PB-210	6,5319E-02	1,4012E-01
410006	HAKE	PB	PB-210	-3,5747E-01	8,7418E-02
410006	OCTOPOD	PB	PB-210	-9,0829E-02	9,9793E-02
410006	SCALLOPS	PB	PB-210	-1,6823E-01	1,8318E-01
410006	SHRIMP	PB	PB-210	1,3800E-01	2,1441E-01
401003	CRABS	PO	PO-210	1,8764E-01	3,6657E-02
401003	FLOUNDER	PO	PO-210	1,9781E-02	1,2699E-02
401003	HAKE	PO	PO-210	3,7170E-02	1,6750E-02
401003	OCTOPOD	PO	PO-210	5,7186E-02	1,5569E-02
401003	SHRIMP	PO	PO-210	1,7158E-01	4,1652E-02
401003	SHRIMP	PO	PO-210	8,7415E-02	2,1903E-02
403004	FLOUNDER	PO	PO-210	2,4731E-02	9,6907E-03
403004	HAKE	PO	PO-210	2,4020E-02	1,1831E-02
403004	OCTOPOD	PO	PO-210	6,3906E-02	1,5605E-02
403004	SCALLOPS	PO	PO-210	2,7491E-01	4,9000E-02
404010	CRABS	PO	PO-210	1,2578E-01	4,4447E-02
404010	FLOUNDER	PO	PO-210	2,2717E-02	8,6788E-03
404010	HAKE	PO	PO-210	2,5178E-02	1,0466E-02
404010	OCTOPOD	PO	PO-210	5,0349E-02	1,2341E-02
404010	SCALLOPS	PO	PO-210	1,1525E-01	2,1923E-02
404010	SHRIMP	PO	PO-210	3,1510E-01	6,3840E-02
408005	FLOUNDER	PO	PO-210	3,4780E-02	1.7260E-02
408005	HAKE	PO	PO-210	1,4233E-02	8.5578E-03
408005	HAKE	PO	PO-210	2,6240E-02	1,1669E-02
408005	OCTOPOD	PO	PO-210	4,2829E-02	1,5032E-02
408005	SCALLOPS	PO	PO-210	1,5049E-01	3,2344E-02
410006	FLOUNDER	PO	PO-210	1,5837E-02	8,6526E-03
410006	HAKE	PO	PO-210	1,6058E-02	6,3180E-03
410006	OCTOPOD	PO	PO-210	4,7593E-02	1,2641E-02
410006	SCALLOPS	PO	PO-210	1,1422E-01	2,3076E-02
410006	SHRIMP	PO	PO-210	1,4584E-01	3,6343E-02
401003	CRABS	RA	RA-226	3,0000E-02	2,1000E-03

401003	FLOUNDER	RA	RA-226	3.0000E-03	8.4000E-04
401003	HAKE	RA	RA-226	5.0000E-03	5.5000E-04
401003	OCTOPOD	RA	RA-226	2.0000E-03	5.0000E-04
401003	SHRIMP	RA	RA-226	1.4000E-02	1.6800E-03
401003	SHRIMP	RA	RA-226	1.6000E-02	1.6000E-03
403004	FLOUNDER	RA	RA-226	3.0000E-03	5.4000E-04
403004	HAKE	RA	RA-226	4.0000E-03	4.8000E-04
403004	SCALLOPS	RA	RA-226	1.0000E-02	1.0000E-03
403004	SHRIMP	RA	RA-226	2.7000E-02	2.1600E-03
404010	CRABS	RA	RA-226	3.0000E-02	2.1000E-03
404010	FLOUNDER	RA	RA-226	1.0000E-03	4.6000E-04
404010	HAKE	RA	RA-226	6.0000E-03	6.6000E-04
404010	SHRIMP	RA	RA-226	3.0000E-02	2.4000E-03
408005	FLOUNDER	RA	RA-226	2.0000E-03	3.8000E-04
408005	HAKE	RA	RA-226	2.0000E-03	3.0000E-04
408005	HAKE	RA	RA-226	2.0000E-03	3.8000E-04
408005	OCTOPOD	RA	RA-226	4.0000E-03	9.6000E-04
408005	SCALLOPS	RA	RA-226	6.0000E-03	7.2000E-04
408005	SHRIMP	RA	RA-226	1.5000E-02	1.6500E-03
410006	FLOUNDER	RA	RA-226	4.0000E-03	5.6000E-04
410006	HAKE	RA	RA-226	2.0000E-03	4.6000E-04
410006	SHRIMP	RA	RA-226	6.0000E-03	1.2000E-03
401003	CRABS	TH	TH-227	4.6180E-03	2.0110E-03
401003	HAKE	TH	TH-227	2.1370E-04	4.2760E-04
401003	SHRIMP	TH	TH-227	1.5300E-03	1.4510E-03
401003	SHRIMP	TH	TH-227	8.7540E-04	8.7560E-04
403004	FLOUNDER	TH	TH-227	3.2520E-04	3.9850E-04
403004	HAKE	TH	TH-227	3.6600E-04	2.9910E-04
403004	SHRIMP	TH	TH-227	3.1280E-03	1.9180E-03
404010	FLOUNDER	TH	TH-227	3.6080E-03	5.1040E-03
404010	HAKE	TH	TH-227	8.1020E-04	5.4080E-04
404010	SHRIMP	TH	TH-227	5.8170E-02	2.9410E-02
408005	HAKE	TH	TH-227	2.2920E-04	3.2420E-04
408005	SCALLOPS	TH	TH-227	2.1120E-03	1.5590E-03
408005	SHRIMP	TH	TH-227	4.1550E-04	5.8780E-04
410006	FLOUNDER	TH	TH-227	-7.3150E-05	3.8710E-04
410006	HAKE	TH	TH-227	4.5600E-04	4.3220E-04
410006	SHRIMP	TH	TH-227	-1.7630E-04	7.8840E-04
401003	CRABS	TH	TH-228	3.7110E-02	4.3770E-03
401003	HAKE	TH	TH-228	5.9350E-04	6.6140E-04
401003	SHRIMP	TH	TH-228	4.2800E-03	2.5800E-03
401003	SHRIMP	TH	TH-228	5.1310E-03	2.6470E-03
403004	FLOUNDER	TH	TH-228	2.3080E-03	9.9430E-04
403004	HAKE	TH	TH-228	9.2390E-04	6.6990E-04
403004	SHRIMP	TH	TH-228	1.5780E-02	3.1540E-03
404010	FLOUNDER	TH	TH-228	-6.1920E-03	9.3520E-03
404010	HAKE	TH	TH-228	4.1320E-03	1.0030E-03
404010	SHRIMP	TH	TH-228	3.8350E-01	5.4140E-02
408005	HAKE	TH	TH-228	1.0540E-04	6.2120E-04
408005	SCALLOPS	TH	TH-228	8.9130E-03	2.8590E-03
408005	SHRIMP	TH	TH-228	2.8590E-03	2.3480E-03
410006	FLOUNDER	TH	TH-228	1.0500E-03	8.0690E-04
410006	HAKE	TH	TH-228	9.2160E-04	7.4220E-04
410006	SHRIMP	TH	TH-228	2.9070E-03	1.9870E-03
401003	CRABS	TH	TH-230	1.2820E-02	2.3240E-03

401003	HAKE	TH	TH-230	8.5500E-04	3.5680E-04
401003	SHRIMP	TH	TH-230	3.3580E-03	1.3940E-03
401003	SHRIMP	TH	TH-230	3.9920E-03	1.3650E-03
403004	FLOUNDER	TH	TH-230	1.9120E-03	5.4980E-04
403004	HAKE	TH	TH-230	1.1420E-03	3.7680E-04
403004	SHRIMP	TH	TH-230	1.5390E-02	2.4660E-03
404010	FLOUNDER	TH	TH-230	9.0920E-03	4.5100E-03
404010	HAKE	TH	TH-230	4.3100E-03	7.6550E-04
404010	SHRIMP	TH	TH-230	3.3800E-01	4.6210E-02
408005	HAKE	TH	TH-230	8.2510E-04	3.3060E-04
408005	SCALLOPS	TH	TH-230	2.9290E-03	1.3560E-03
408005	SHRIMP	TH	TH-230	3.7900E-03	1.2990E-03
410006	FLOUNDER	TH	TH-230	7.0220E-04	3.1450E-04
410006	HAKE	TH	TH-230	1.0940E-03	3.7080E-04
410006	SHRIMP	TH	TH-230	2.7080E-03	9.6120E-04
401003	CRABS	TH	TH-232	1.4360E-02	2.4080E-03
401003	HAKE	TH	TH-232	8.5500E-04	3.6970E-04
401003	SHRIMP	TH	TH-232	2.9380E-03	1.1130E-03
401003	SHRIMP	TH	TH-232	3.5720E-03	1.3320E-03
403004	FLOUNDER	TH	TH-232	1.9120E-03	5.6080E-04
403004	HAKE	TH	TH-232	9.9560E-04	3.5280E-04
403004	SHRIMP	TH	TH-232	1.7640E-02	2.6460E-03
404010	FLOUNDER	TH	TH-232	6.9270E-03	3.6810E-03
404010	HAKE	TH	TH-232	4.5050E-03	7.7750E-04
404010	SHRIMP	TH	TH-232	3.6740E-01	4.7660E-02
408005	HAKE	TH	TH-232	8.5260E-04	3.1660E-04
408005	SCALLOPS	TH	TH-232	3.7180E-03	1.3010E-03
408005	SHRIMP	TH	TH-232	2.5930E-03	1.1320E-03
410006	FLOUNDER	TH	TH-232	4.2130E-04	2.4350E-04
410006	HAKE	TH	TH-232	8.7550E-04	3.3150E-04
410006	SHRIMP	TH	TH-232	1.4380E-03	6.9930E-04
401003	CRABS	U	U-234	2.3520E-02	4.3430E-03
401003	FLOUNDER	U	U-234	2.1490E-03	6.4380E-04
401003	HAKE	U	U-234	1.6510E-03	5.0300E-04
401003	SHRIMP	U	U-234	5.2070E-03	1.7200E-03
403004	FLOUNDER	U	U-234	3.3590E-03	9.2550E-04
403004	HAKE	U	U-234	1.9850E-03	6.0720E-04
403004	SHRIMP	U	U-234	1.9770E-02	3.9600E-03
404010	FLOUNDER	U	U-234	1.2920E-02	6.5520E-03
404010	HAKE	U	U-234	4.6010E-03	1.0360E-03
404010	SHRIMP	U	U-234	2.8360E-02	5.0230E-03
408005	HAKE	U	U-234	1.4670E-03	5.1780E-04
408005	HAKE	U	U-234	2.4140E-03	8.3760E-04
408005	OCTOPOD	U	U-234	1.0010E-02	2.0270E-03
408005	SCALLOPS	U	U-234	1.0080E-02	3.0770E-03
408005	SHRIMP	U	U-234	4.8030E-03	1.8750E-03
410006	FLOUNDER	U	U-234	2.4700E-03	7.1410E-04
410006	HAKE	U	U-234	3.1030E-03	8.7760E-04
410006	SHRIMP	U	U-234	6.1150E-03	1.8800E-03
401003	CRABS	U	U-235	1.7340E-03	9.9070E-04
401003	FLOUNDER	U	U-235	-4.1470E-05	8.3030E-05
401003	HAKE	U	U-235	1.1300E-04	1.2340E-04
401003	SHRIMP	U	U-235	0.0000E-01	0.0000E-01
403004	FLOUNDER	U	U-235	1.9060E-05	6.4690E-05
403004	HAKE	U	U-235	1.3360E-04	1.8420E-04

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 403004   SHRIMP              U           U-235       2.9450E-03  1.4870E-03
 404010   FLOUNDER            U           U-235       3.0040E-03  3.0980E-03
 404010   HAKE                U           U-235       1.4190E-03  5.1360E-04
 404010   SHRIMP              U           U-235       1.7450E-03  1.0240E-03
 408005   HAKE                U           U-235       1.2050E-04  1.7630E-04
 408005   HAKE                U           U-235       1.2800E-04  1.4660E-04
 408005   OCTOPOD             U           U-235       2.1510E-04  3.3740E-04
 408005   SCALLOPS            U           U-235       6.5240E-04  6.7760E-04
 408005   SHRIMP              U           U-235       0.0000E-01  0.0000E-01
 410006   FLOUNDER            U           U-235       1.8100E-04  1.8230E-04
 410006   HAKE                U           U-235       1.3350E-05  1.5810E-04
 410006   SHRIMP              U           U-235       2.1710E-04  3.0220E-04
 401003   CRABS               U           U-238       2.4050E-02  4.4060E-03
 401003   FLOUNDER            U           U-238       1.3210E-03  4.8550E-04
 401003   HAKE                U           U-238       1.2820E-03  4.3680E-04
 401003   SHRIMP              U           U-238       1.0110E-02  2.5020E-03
 403004   FLOUNDER            U           U-238       3.0630E-03  8.7820E-04
 403004   HAKE                U           U-238       1.5800E-03  5.2600E-04
 403004   SHRIMP              U           U-238       1.3320E-02  3.0960E-03
 404010   FLOUNDER            U           U-238       1.3680E-02  6.7520E-03
 404010   HAKE                U           U-238       3.7410E-03  9.0010E-04
 404010   SHRIMP              U           U-238       2.6180E-02  4.7790E-03
 408005   HAKE                U           U-238       2.3520E-03  8.4500E-04
 408005   HAKE                U           U-238       2.4100E-03  6.8240E-04
 408005   OCTOPOD             U           U-238       7.9970E-03  1.7880E-03
 408005   SCALLOPS            U           U-238       9.9300E-03  2.9320E-03
 408005   SHRIMP              U           U-238       6.8740E-03  2.2450E-03
 410006   FLOUNDER            U           U-238       1.8100E-03  6.0150E-04
 410006   HAKE                U           U-238       2.2530E-03  7.3220E-04
 410006   SHRIMP              U           U-238       7.1420E-03  1.8890E-03

          AREA 4    GROSS ALPHA

 401003   CRABS             ALPHA       ALPHA       1.0000E-01  2.7400E-01
 401003   FLOUNDER          ALPHA       ALPHA      -3.0000E-01  2.1000E-01
 401003   HAKE              ALPHA       ALPHA      -4.0000E-02  1.6000E-01
 401003   OCTOPOD           ALPHA       ALPHA      -2.0000E-02  1.8320E-01
 401003   SHRIMP            ALPHA       ALPHA      -2.0000E-01  2.3000E-01
 401003   SHRIMP            ALPHA       ALPHA      -4.0000E-01  2.6800E-01
 403004   FLOUNDER          ALPHA       ALPHA      -2.0000E-01  2.3600E-01
 403004   HAKE              ALPHA       ALPHA      -2.0000E-02  1.9180E-01
 403004   OCTOPOD           ALPHA       ALPHA      -1.0000E-01  1.7600E-01
 403004   SCALLOPS          ALPHA       ALPHA       2.0000E-01  2.5600E-01
 403004   SHRIMP            ALPHA       ALPHA      -1.0000E-01  2.7400E-01
 404010   CRABS             ALPHA       ALPHA       2.0000E-01  2.7400E-01
 404010   FLOUNDER          ALPHA       ALPHA      -5.0000E-01  7.0500E-01
 404010   HAKE              ALPHA       ALPHA      -1.0000E-01  1.2500E-01
 404010   OCTOPOD           ALPHA       ALPHA       0.0000E-01  0.0000E-01
 404010   SCALLOPS          ALPHA       ALPHA      -8.0000E-01  9.4400E-01
 404010   SHRIMP            ALPHA       ALPHA      -5.0000E-02  1.8700E-01
 408005   FLOUNDER          ALPHA       ALPHA      -2.0000E-02  1.3260E-01
 408005   HAKE              ALPHA       ALPHA      -1.0000E-01  8.2400E-01
 408005   HAKE              ALPHA       ALPHA      -1.0000E-01  8.7200E-01
 408005   OCTOPOD           ALPHA       ALPHA      -1.0000E-01  1.0500E-01
 408005   SCALLOPS          ALPHA       ALPHA      -2.0000E-01  8.4800E-01
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408005  SHRIMP            ALPHA    ALPHA    -1.2000E+00  1.2720E+00
410006  FLOUNDER          ALPHA    ALPHA    -1.2000E+00  1.2720E+00
410006  HAKE              ALPHA    ALPHA     1.0000E-01  7.7500E-01
410006  OCTOPOD           ALPHA    ALPHA    -5.0000E-01  7.0500E-01
410006  SCALLOPS          ALPHA    ALPHA    -1.0000E+00  8.7000E-01
410006  SHRIMP            ALPHA    ALPHA     4.0000E-01  1.2240E+00

        AREA 4   GROSS BETA

401003  CRABS             BETA     BETA      2.7000E+00  2.7000E-01
401003  FLOUNDER          BETA     BETA      3.9000E+00  3.1200E-01
401003  HAKE              BETA     BETA      4.1000E+00  2.8700E-01
401003  OCTOPOD           BETA     BETA      2.1000E+00  2.1000E-01
401003  SHRIMP            BETA     BETA      3.3000E+00  3.3000E-01
401003  SHRIMP            BETA     BETA      3.7000E+00  3.3300E-01
403004  FLOUNDER          BETA     BETA      4.2000E+00  3.3600E-01
403004  HAKE              BETA     BETA      4.6000E+00  3.2200E-01
403004  OCTOPOD           BETA     BETA      2.8000E+00  2.8000E-01
403004  SCALLOPS          BETA     BETA      2.1000E+00  1.8900E-01
403004  SHRIMP            BETA     BETA      4.2000E+00  3.3600E-01
404010  CRABS             BETA     BETA      2.7000E+00  2.4300E-01
404010  FLOUNDER          BETA     BETA      1.7000E+01  1.3600E+00
404010  HAKE              BETA     BETA      4.4000E+00  3.0800E-01
404010  OCTOPOD           BETA     BETA      2.2000E+00  2.2000E-01
404010  SCALLOPS          BETA     BETA      1.8700E+01  1.4960E+00
404010  SHRIMP            BETA     BETA      3.6000E+00  2.8800E-01
408005  FLOUNDER          BETA     BETA      3.9000E+00  3.1200E-01
408005  HAKE              BETA     BETA      2.0000E+01  1.6000E+00
408005  HAKE              BETA     BETA      2.1400E+01  1.4980E+00
408005  OCTOPOD           BETA     BETA      2.6000E+00  2.3400E-01
408005  SCALLOPS          BETA     BETA      1.4900E+01  1.3410E+00
408005  SHRIMP            BETA     BETA      1.3500E+01  1.3500E+00
410006  FLOUNDER          BETA     BETA      1.8600E+01  1.4880E+00
410006  HAKE              BETA     BETA      2.1000E+01  1.4700E+00
410006  OCTOPOD           BETA     BETA      1.1800E+01  1.1800E+00
410006  SCALLOPS          BETA     BETA      2.1200E+01  1.4840E+00
410006  SHRIMP            BETA     BETA      1.3100E+01  1.1790E+00

        AREA 5   NATURAL NUCLIDES

501149  FLOUNDER          GAMMA    BI-214    4.2000E-02  2.7720E-02
501149  FLOUNDER          GAMMA    K-40      3.2000E+00  2.8800E-01
501149  FLOUNDER          PB       PB-210   -2.9435E-03  1.2677E-01
501149  FLOUNDER          GAMMA    PB-214    3.7000E-02  2.4050E-02
501149  FLOUNDER          PO       PO-210    3.6998E-02  1.1814E-02
501149  FLOUNDER          RA       RA-226    1.0000E-02  1.3000E-03

        AREA 5   GROSS ALPHA

501149  FLOUNDER          ALPHA    ALPHA     1.0000E-01  2.7500E-01

        AREA 5   GROSS BETA

501149  FLOUNDER          BETA     BETA      2.7000E+00  2.9700E-01
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Radionuclide Analyses of Nonedible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

Sample Number	Sample Type	Analysis	Nuclide	Activity pCi/g (wet)	2-Sigma Error
	AREA 1 MAN-MADE NUCLIDES				
105085	LIZARDFISH	GAMMA	CS-137	6,2000E-02	1.7360E-02
115090	LIZARDFISH	GAMMA	CS-137	1.2000E-02	8,0400E-03
101083	KRILL	PU	PU-238	-8,0260E-05	3,7670E-04
102084	KRILL	PU	PU-238	3,6960E-05	2,1714E-04
104088	SKATE	PU	PU-238	-1,7360E-04	3,4950E-04
115090	LIZARDFISH	PU	PU-238	1,3200E-05	1,9140E-04
118091	LIZARDFISH	PU	PU-238	3,4370E-05	1,0750E-04
124092	LIZARDFISH	PU	PU-238	5,1190E-04	5,2260E-04
101083	KRILL	PU	PU-239	-6,1000E-05	3,2580E-04
102084	KRILL	PU	PU-239	1,2200E-04	1,5656E-04
104088	SKATE	PU	PU-239	9,3200E-05	2,3970E-04
115090	LIZARDFISH	PU	PU-239	2,3300E-05	4,8440E-05
118091	LIZARDFISH	PU	PU-239	-7,7010E-05	7,7490E-05
124092	LIZARDFISH	PU	PU-239	5,2050E-05	1,2200E-04
101083	KRILL	SR	SR-90	-1,5000E-03	4,2000E-03
102084	KRILL	SR	SR-90	-1,1000E-02	2,7830E-02
104088	SKATE	SR	SR-90	-6,3000E-03	1.0521E-02
115090	LIZARDFISH	SR	SR-90	-9,8000E-04	1,8228E-03
118091	LIZARDFISH	SR	SR-90	7,0000E-04	5,9010E-03
124092	LIZARDFISH	SR	SR-90	2,0000E-04	1,1000E-02
	AREA 1 NATURAL NUCLIDES				
105085	LIZARDFISH	GAMMA	BI-214	7,0000E-02	3,0800E-02
101083	HAGFISH	GAMMA	K-40	1,7000E+00	1,8020E+00
101083	HAGFISH	GAMMA	K-40	3,4000E+00	1,9720E+00
101083	KRILL	GAMMA	K-40	2,8000E+00	2,2400E-01
103086	SKATE	GAMMA	K-40	2,0000E+00	2,8000E-01
104088	SKATE	GAMMA	K-40	1,5000E+00	3,1500E-01
105085	LIZARDFISH	GAMMA	K-40	2,8000E+00	3,0800E-01
115090	LIZARDFISH	GAMMA	K-40	3,5000E+00	2,1000E-01
118091	LIZARDFISH	GAMMA	K-40	3,7000E+00	2,2200E-01
118091	STARFISH	GAMMA	K-40	2,2000E+00	3,3000E-01
122093	LIZARDFISH	GAMMA	K-40	5,2000E+00	4,6800E-01
124092	LIZARDFISH	GAMMA	K-40	3,2000E+00	1,9200E-01
101083	KRILL	PB	PB-210	1,6140E-01	1,5504E-01
102084	KRILL	PB	PB-210	-4,5440E-02	3,2380E-01
103086	SKATE	PB	PB-210	1,2020E-02	1,6267E-01
104088	SKATE	PB	PB-210	1,1623E-01	1,9893E-01
115090	LIZARDFISH	PB	PB-210	-1,8148E-02	1,9070E-01
118091	LIZARDFISH	PB	PB-210	-2,0356E-02	7,7902E-01
124092	LIZARDFISH	PB	PB-210	-6,4816E-02	1,7204E-01
105085	LIZARDFISH	GAMMA	PB-214	6,0000E-02	2,9400E-02
101083	KRILL	PO	PO-210	2,7199E-02	9,1381E-03
102084	KRILL	PO	PO-210	2,3620E-02	9,4340E-03
103086	SKATE	PO	PO-210	2,1253E-02	9,3079E-03

104088	SKATE	PO	PO-210	5.6058E-03	4.2426E-03
115090	LIZARDFISH	PO	PO-210	1.6494E-02	6.9999E-03
118091	LIZARDFISH	PO	PO-210	3.9178E-02	1.4345E-02
124092	LIZARDFISH	PO	PO-210	5.1948E-02	1.6514E-02
101083	KRILL	RA	RA-226	1.0000E-02	8.0000E-04
102084	KRILL	RA	RA-226	1.0000E-02	1.0000E-03
103086	SKATE	RA	RA-226	3.0000E-02	2.1000E-03
104088	SKATE	RA	RA-226	1.0000E-02	8.0000E-04
115090	LIZARDFISH	RA	RA-226	4.0000E-03	4.8000E-04
118091	LIZARDFISH	RA	RA-226	2.0000E-03	2.6000E-04
124092	LIZARDFISH	RA	RA-226	4.0000E-03	4.8000E-04
101083	KRILL	TH	TH-227	3.5790E-04	7.1580E-04
102084	KRILL	TH	TH-227	1.2920E-04	6.8360E-04
104088	SKATE	TH	TH-227	2.9750E-04	5.9500E-04
115090	LIZARDFISH	TH	TH-227	8.5030E-04	1.5000E-03
118091	LIZARDFISH	TH	TH-227	7.6420E-04	7.6500E-04
124092	LIZARDFISH	TH	TH-227	6.4960E-04	5.1400E-04
101083	KRILL	TH	TH-228	3.3680E-03	1.2400E-03
102084	KRILL	TH	TH-228	2.1150E-03	1.2620E-03
104088	SKATE	TH	TH-228	3.6450E-03	1.2050E-03
115090	LIZARDFISH	TH	TH-228	1.5680E-03	2.1740E-03
118091	LIZARDFISH	TH	TH-228	-7.3800E-04	5.7280E-04
124092	LIZARDFISH	TH	TH-228	7.7000E-04	7.6260E-04
101083	KRILL	TH	TH-230	2.7490E-03	8.1250E-04
102084	KRILL	TH	TH-230	1.7980E-03	6.7070E-04
104088	SKATE	TH	TH-230	5.8540E-03	1.1790E-03
115090	LIZARDFISH	TH	TH-230	2.4490E-03	1.2180E-03
118091	LIZARDFISH	TH	TH-230	1.0550E-03	4.7890E-04
124092	LIZARDFISH	TH	TH-230	5.8460E-04	3.7430E-04
105085	LIZARDFISH	GAMMA	TH-232	8.0000E-02	4.4000E-02
101083	KRILL	TH	TH-232	1.8320E-03	6.4940E-04
102084	KRILL	TH	TH-232	6.2010E-04	4.6450E-04
104088	SKATE	TH	TH-232	4.9020E-03	9.9210E-04
115090	LIZARDFISH	TH	TH-232	1.2240E-03	8.1690E-04
118091	LIZARDFISH	TH	TH-232	5.0440E-04	3.7880E-04
124092	LIZARDFISH	TH	TH-232	9.7440E-04	4.3520E-04
101083	KRILL	U	U-234	6.7270E-03	1.6360E-03
102084	KRILL	U	U-234	4.5680E-03	1.1817E-03
104088	SKATE	U	U-234	8.6880E-03	1.7270E-03
115090	LIZARDFISH	U	U-234	6.7630E-03	2.0200E-03
118091	LIZARDFISH	U	U-234	8.9200E-04	3.9220E-04
124092	LIZARDFISH	U	U-234	3.9870E-03	1.2990E-03
101083	KRILL	U	U-235	9.2330E-04	6.2810E-04
102084	KRILL	U	U-235	1.5670E-04	1.9551E-04
104088	SKATE	U	U-235	1.3030E-03	6.3540E-04
115090	LIZARDFISH	U	U-235	8.2660E-04	6.5930E-04
118091	LIZARDFISH	U	U-235	3.7920E-05	7.7320E-05
124092	LIZARDFISH	U	U-235	2.6440E-04	4.3380E-04
101083	KRILL	U	U-238	4.2210E-03	1.1950E-03
102084	KRILL	U	U-238	3.6290E-03	1.0216E-03
104088	SKATE	U	U-238	4.8410E-03	1.2200E-03
115090	LIZARDFISH	U	U-238	1.2110E-03	8.8060E-04
118091	LIZARDFISH	U	U-238	1.4650E-03	5.1690E-04
124092	LIZARDFISH	U	U-238	2.2890E-03	9.2240E-04

AREA 1 GROSS ALPHA

101083	KRILL	ALPHA	ALPHA	-4,0000E-02	1,6960E-01
102084	KRILL	ALPHA	ALPHA	0,0000E-01	0,0000E-01
103086	SKATE	ALPHA	ALPHA	-1,0000E-01	1,3300E-01
104088	SKATE	ALPHA	ALPHA	-1,0000E-01	1,8700E-01
105085	LIZARDFISH	ALPHA	ALPHA	-3,0000E-01	3,1800E-01
115090	LIZARDFISH	ALPHA	ALPHA	-2,0000E-01	1,5800E-01
118091	LIZARDFISH	ALPHA	ALPHA	-2,0000E-02	1,2000E-01
122093	LIZARDFISH	ALPHA	ALPHA	-2,0000E-01	1,8800E-01
124092	LIZARDFISH	ALPHA	ALPHA	-2,0000E-02	1,6500E-01

AREA 1 GROSS BETA

101083	KRILL	BETA	BETA	3,8000E+00	3,0400E-01
102084	KRILL	BETA	BETA	3,1000E+00	2,4800E-01
103086	SKATE	BETA	BETA	2,5000E+00	2,5000E-01
104088	SKATE	BETA	BETA	2,1000E+00	2,1000E-01
105085	LIZARDFISH	BETA	BETA	4,3000E+00	3,4400E-01
115090	LIZARDFISH	BETA	BETA	3,4000E+00	2,7200E-01
118091	LIZARDFISH	BETA	BETA	4,4000E+00	3,0800E-01
122093	LIZARDFISH	BETA	BETA	4,9000E+00	3,4300E-01
124092	LIZARDFISH	BETA	BETA	4,7000E+00	3,2900E-01

AREA 2 MAN-MADE NUCLIDES

202143	KRILL	GAMMA	CO-60	0,0000E-01	0,0000E-01
202143	KRILL	GAMMA	CS-137	5,0000E-03	3,9500E-03
202143	KRILL	PU	PU-238	7,1640E-01	4,9690E-01
202143	KRILL	PU	PU-239	4,3090E-03	9,6950E-03
202143	KRILL	SR	SR-90	-7,0000E-04	3,2000E-03

AREA 2 NATURAL NUCLIDES

202143	KRILL	GAMMA	K-40	1,4000E+00	1,9600E-01
202143	KRILL	PB	PB-210	-7,4513E-03	8,9121E-02
202143	KRILL	PO	PO-210	9,8167E-02	1,9902E-02
202143	KRILL	RA	RA-226	8,0000E-03	9,6000E-04
202143	KRILL	TH	TH-227	-1,5600E-03	6,9770E-03
202143	KRILL	TH	TH-228	2,0160E-02	1,9720E-02
202143	KRILL	TH	TH-230	2,0220E-02	7,8100E-03
202143	KRILL	TH	TH-232	1,0480E-02	6,0000E-03
202143	KRILL	U	U-234	1,0820E-02	3,3370E-03
202143	KRILL	U	U-235	3,1940E-04	5,1400E-04
202143	KRILL	U	U-238	7,1550E-03	2,6190E-03

AREA 2 GROSS ALPHA

202143	KRILL	ALPHA	ALPHA	1,0000E-01	1,3700E-01

AREA 2 GROSS BETA

202143	KRILL	BETA	BETA	2,2000E+00	1,5400E-01

AREA 3 MAN-MADE NUCLIDES

301106	KRILL	PU	PU-238	3,0780E-04	3,9050E-04
301106	KRILL	PU	PU-239	1,2090E-04	1,5300E-04

AREA 3 NATURAL NUCLIDES

301106	KRILL	GAMMA	K-40	3,6000E-01	1,2240E-01
312107	SEA CUCUMBER	GAMMA	K-40	1,8000E+00	2,1600E-01
312107	SPONGE	GAMMA	K-40	1,8000E+00	5,9400E-01
301106	KRILL	PB	PB-210	9,0289E-03	3,9315E-02
301106	KRILL	PO	PO-210	2,8163E-03	1,4197E-03
301106	KRILL	RA	RA-226	6,0000E-03	7,8000E-04
301106	KRILL	TH	TH-227	1,6130E-03	9,0320E-04
301106	KRILL	TH	TH-228	9,7020E-03	1,6650E-03
301106	KRILL	TH	TH-230	3,8240E-03	8,7850E-04
301106	KRILL	TH	TH-232	3,6300E-03	8,5620E-04
301106	KRILL	U	U-234	1,1020E-02	2,2690E-03
301106	KRILL	U	U-235	8,0420E-04	5,1640E-04
301106	KRILL	U	U-238	7,5600E-03	1,7710E-03

AREA 3 GROSS ALPHA

301106	KRILL	ALPHA	ALPHA	-1,0000E-02	8,1000E-03
312107	SEA CUCUMBER	ALPHA	ALPHA	1,0000E-02	6,0000E-02
312107	SPONGE	ALPHA	ALPHA	0,0000E-01	0,0000E-01

AREA 3 GROSS BETA

301106	KRILL	BETA	BETA	4,0000E-01	4,0000E-02
312107	SEA CUCUMBER	BETA	BETA	1,7000E+00	1,5300E-01
312107	SPONGE	BETA	BETA	3,3000E+00	2,3100E-01

AREA 4 MAN-MADE NUCLIDES

402007	PLANKTON	PU	PU-238	3,9340E-04	6,1140E-04
402007	PLANKTON	PU	PU-238	8,8620E-04	1,0550E-03
406009	PLANKTON	PU	PU-238	-2,8670E-04	5,1810E-04
409008	PLANKTON	PU	PU-238	1,7310E-03	1,1030E-03
402007	PLANKTON	PU	PU-239	2,5600E-04	3,6260E-04
402007	PLANKTON	PU	PU-239	9,4270E-05	1,8040E-04
406009	PLANKTON	PU	PU-239	-4,1790E-05	3,3540E-04
409008	PLANKTON	PU	PU-239	-5,3880E-05	4,9370E-04
402007	PLANKTON	SR	SR-90	-1,0000E-02	5,9000E-03
402007	PLANKTON	SR	SR-90	-5,0000E-03	3,7500E-03

AREA 4 NATURAL NUCLIDES

402007	PLANKTON	GAMMA	K-40	4,1000E-01	1,1890E-01
402007	PLANKTON	GAMMA	K-40	5,7000E-01	1,4250E-01
406009	PLANKTON	GAMMA	K-40	1,0000E+00	1,8000E-01
409008	PLANKTON	GAMMA	K-40	1,2000E+00	5,6400E-01
402007	PLANKTON	PB	PB-210	9,2810E-02	8,6089E-02
402007	PLANKTON	PB	PB-210	-1,1004E-01	1,3359E-01

406009	PLANKTON	PB	PB-210	-3,2823E-03	1,1250E-01
409008	PLANKTON	PB	PB-210	-2,1839E-02	1,0228E-01
402007	PLANKTON	PO	PO-210	1,1439E-02	4,6451E-03
402007	PLANKTON	PO	PO-210	1,2364E-02	4,6361E-03
406009	PLANKTON	PO	PO-210	5,6553E-03	2,4043E-03
409008	PLANKTON	PO	PO-210	6,7938E-03	3,6523E-03
402007	PLANKTON	RA	RA-226	6,0000E-03	1,0800E-03
402007	PLANKTON	RA	RA-226	6,0000E-03	8,4000E-04
406009	PLANKTON	RA	RA-226	2,0000E-03	3,8000E-04
409008	PLANKTON	RA	RA-226	1,0000E-03	3,6000E-04
402007	PLANKTON	TH	TH-227	6,1770E-04	5,5290E-04
406009	PLANKTON	TH	TH-227	1,0150E-04	2,0310E-04
409008	PLANKTON	TH	TH-227	0,0000E-01	1,0680E-03
402007	PLANKTON	TH	TH-228	-4,9280E-04	9,4880E-04
406009	PLANKTON	TH	TH-228	7,8060E-04	6,0200E-04
409008	PLANKTON	TH	TH-228	-1,2010E-03	2,0100E-03
402007	PLANKTON	TH	TH-230	3,5580E-04	4,1100E-04
406009	PLANKTON	TH	TH-230	1,7060E-04	1,2910E-04
409008	PLANKTON	TH	TH-230	9,4140E-04	6,2850E-04
402007	PLANKTON	TH	TH-232	1,7790E-04	2,6530E-04
406009	PLANKTON	TH	TH-232	1,4620E-04	1,1950E-04
409008	PLANKTON	TH	TH-232	2,0920E-04	2,9600E-04
402007	PLANKTON	U	U-234	1,2800E-02	2,2620E-03
[illegible]	PLANKTON	U	U-234	1,8180E-02	2,9330E-03
[illegible]	PLANKTON	U	U-234	7,9310E-03	1,4110E-03
409008	PLANKTON	U	U-234	3,3650E-02	5,5270E-03
402007	PLANKTON	U	U-235	3,4480E-04	2,9210E-04
402007	PLANKTON	U	U-235	7,8630E-04	4,5330E-04
406009	PLANKTON	U	U-235	6,7680E-04	3,3340E-04
409008	PLANKTON	U	U-235	7,8930E-04	8,5090E-04
402007	PLANKTON	U	U-238	1,0130E-02	1,9280E-03
402007	PLANKTON	U	U-238	7,9020E-03	1,6590E-03
406009	PLANKTON	U	U-238	6,5460E-03	1,2390E-03
409008	PLANKTON	U	U-238	2,3160E-02	4,2550E-03

AREA 4 GROSS ALPHA

402007	PLANKTON	ALPHA	ALPHA	-2,0000E-02	6,9200E-02
402007	PLANKTON	ALPHA	ALPHA	-2,0000E-02	7,4800E-02
406009	PLANKTON	ALPHA	ALPHA	-5,0000E-01	1,0000E+00
409008	PLANKTON	ALPHA	ALPHA	-7,0000E-01	7,3500E-01

AREA 4 GROSS BETA

402007	PLANKTON	BETA	BETA	8,0000E-01	8,8000E-02
402007	PLANKTON	BETA	BETA	8,0000E-01	8,8000E-02
406009	PLANKTON	BETA	BETA	1,2700E+01	1,2700E+00
409008	PLANKTON	BETA	BETA	1,3200E+01	1,1880E+00

Radionuclide Analyses of Sediment Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

Sample Number	Analysis	Nuclide	Activity pCi/g (dry)	2-Sigma Error
	AREA 1	MAN-MADE NUCLIDES		
101081	GAMMA	CS-137	8,0000E-02	2,6400E-02
102079	GAMMA	CS-137	9,7170E-02	2,4292E-02
103077	GAMMA	CS-137	2,2264E-01	4,0075E-02
106082	GAMMA	CS-137	1,1000E-01	3,8500E-02
107080	GAMMA	CS-137	4,0000E-02	1,7200E-02
108078	GAMMA	CS-137	1,1074E-01	3,1007E-02
109076	GAMMA	CS-137	1,2000E-01	1,8000E-02
111065	GAMMA	CS-137	1,0000E-01	3,5000E-02
112068	GAMMA	CS-137	1,2000E-01	2,4000E-02
113070	GAMMA	CS-137	1,5000E-01	2,8500E-02
114071	GAMMA	CS-137	9,0000E-02	2,5200E-02
115072	GAMMA	CS-137	1,4000E-01	2,1000E-02
116073	GAMMA	CS-137	7,0000E-02	1,7500E-02
118064	GAMMA	CS-137	1,3000E-01	2,6000E-02
119066	GAMMA	CS-137	1,0000E-01	2,2000E-02
120067	GAMMA	CS-137	1,4364E-01	2,7292E-02
121069	GAMMA	CS-137	1,4000E-01	4,4800E-02
122056	GAMMA	CS-137	1,6750E-01	3,0150E-02
123055	GAMMA	CS-137	1,4579E-01	2,4784E-02
124053	GAMMA	CS-137	3,1400E-02	2,2922E-02
125063	GAMMA	CS-137	1,4000E-01	2,9400E-02
126062	GAMMA	CS-137	1,3260E-01	2,6520E-02
127061	GAMMA	CS-137	1,0320E-01	2,6832E-02
127061	GAMMA	CS-137	7,7400E-02	2,2446E-02
128060	GAMMA	CS-137	1,0363E-01	3,9379E-02
129059	GAMMA	CS-137	7,0000E-02	2,9400E-02
130057	GAMMA	CS-137	1,4208E-01	2,6995E-02
131054	GAMMA	CS-137	1,3000E-01	2,4700E-02
132052	GAMMA	CS-137	1,3200E-01	4,0920E-02
132052	GAMMA	CS-137	1,5312E-01	4,2874E-02
133044	GAMMA	CS-137	1,2000E-01	2,2800E-02
136048	GAMMA	CS-137	1,2096E-01	2,5402E-02
137051	GAMMA	CS-137	1,6170E-01	3,5574E-02
138043	GAMMA	CS-137	1,3000E-01	3,3800E-02
141049	GAMMA	CS-137	1,0127E-01	3,5445E-02
142050	GAMMA	CS-137	1,5004E-01	2,7007E-02
143042	GAMMA	CS-137	1,1781E-01	2,2384E-02
144041	GAMMA	CS-137	1,0000E-01	2,3000E-02
144041	GAMMA	CS-137	1,1000E-01	2,5300E-02
145040	GAMMA	CS-137	1,0080E-01	2,2176E-02
147038	GAMMA	CS-137	1,5200E-01	3,6480E-02
148039	GAMMA	CS-137	1,2495E-01	3,1237E-02
150056	GAMMA	CS-137	8,9440E-02	2,5043E-02
142050	GAMMA	MN-54	1,6940E-02	1,3213E-02
102079	PU	PU-238	1,6045E-02	1,4917E-02
103077	PU	PU-238	7,4076E-03	1,6202E-02

105074	PU	PU-238	1.2281E-02	9.7294E-03
108078	PU	PU-238	1.0880E-02	2.0227E-02
119066	PU	PU-238	1.3760E-02	1.3990E-02
120067	PU	PU-238	1.5189E-02	1.9629E-02
122058	PU	PU-238	1.6687E-02	1.5233E-02
123055	PU	PU-238	3.2456E-03	1.2631E-02
124053	PU	PU-238	1.4738E-02	2.2231E-02
126062	PU	PU-238	3.4320E-03	1.4316E-02
127061	PU	PU-238	1.6923E-02	1.0006E-02
127061	PU	PU-238	8.3635E-03	8.5420E-03
127061	PU	PU-238	9.7416E-03	1.6121E-02
128060	PU	PU-238	1.4672E-02	1.7133E-02
130057	PU	PU-238	1.6657E-02	2.1328E-02
132052	PU	PU-238	1.8485E-02	3.1522E-02
132052	PU	PU-238	6.4073E-03	2.8670E-02
134045	PU	PU-238	3.0079E-02	2.2197E-02
135046	PU	PU-238	1.0165E-02	1.6805E-02
136048	PU	PU-238	1.0922E-02	1.5911E-02
137051	PU	PU-238	3.3859E-04	9.2341E-03
140047	PU	PU-238	1.6312E-02	1.4449E-02
141049	PU	PU-238	2.7318E-02	1.5153E-02
142050	PU	PU-238	4.5786E-03	1.2850E-02
143042	PU	PU-238	2.3932E-02	1.5165E-02
145040	PU	PU-238	1.5053E-02	1.2690E-02
148039	PU	PU-238	2.8249E-03	7.8302E-03
150056	PU	PU-238	7.2696E-03	1.1762E-02
102079	PU	PU-239	3.8560E-02	1.6282E-02
103077	PU	PU-239	3.4001E-02	1.6587E-02
105074	PU	PU-239	1.4542E-02	1.0606E-02
108078	PU	PU-239	6.6354E-02	2.8047E-02
119066	PU	PU-239	1.4960E-02	1.3270E-02
120067	PU	PU-239	6.7784E-02	2.9594E-02
122058	PU	PU-239	4.7900E-02	2.1862E-02
123055	PU	PU-239	5.2939E-02	2.2368E-02
124053	PU	PU-239	1.0896E-02	1.2615E-02
126062	PU	PU-239	3.0784E-02	1.6479E-02
127061	PU	PU-239	1.8711E-02	1.0541E-02
127061	PU	PU-239	2.3199E-02	1.5437E-02
127061	PU	PU-239	3.6249E-02	1.8200E-02
128060	PU	PU-239	8.0325E-03	8.5266E-03
130057	PU	PU-239	1.8737E-02	1.3997E-02
132052	PU	PU-239	2.2424E-02	3.6934E-02
132052	PU	PU-239	3.6960E-02	2.5186E-02
134045	PU	PU-239	0.0000E-01	1.2152E-02
135046	PU	PU-239	2.0336E-03	9.0948E-03
136048	PU	PU-239	2.7037E-02	1.4607E-02
137051	PU	PU-239	8.8421E-02	2.7563E-02
140047	PU	PU-239	3.2651E-03	6.4032E-03
141049	PU	PU-239	6.6468E-02	2.3055E-02
142050	PU	PU-239	6.5679E-02	2.2380E-02
143042	PU	PU-239	3.5944E-02	1.9889E-02
145040	PU	PU-239	9.4058E-02	2.6701E-02
148039	PU	PU-239	4.9588E-02	1.9529E-02
150056	PU	PU-239	2.5771E-02	1.2917E-02
102079	SR	SR-90	1.8960E-02	3.3180E-01

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103077  SR        SR-90     6.5340E-02  5.5996E-01
105074  SR        SR-90     9.5200E-02  2.4752E-01
108078  SR        SR-90     9.0400E-02  2.2148E-01
120067  SR        SR-90     6.8400E-02  2.1341E-01
122058  SR        SR-90     5.0000E-02  4.2500E-01
123055  SR        SR-90     4.5410E-02  2.9971E-01
124053  SR        SR-90     3.1400E-02  3.2185E-01
126062  SR        SR-90     2.6000E-02  3.6400E-01
127061  SR        SR-90     1.9350E-02  3.2895E-01
128060  SR        SR-90     8.6760E-03  3.6439E-01
130057  SR        SR-90     6.2160E-02  3.7296E-01
132052  SR        SR-90     1.3200E-01  5.3592E-01
132052  SR        SR-90     3.6960E-02  4.2504E-01
134045  SR        SR-90     3.7750E-02  5.3794E-01
135046  SR        SR-90     6.6720E-02  5.5311E-01
136048  SR        SR-90     1.1200E-01  7.2800E-01
137051  SR        SR-90     9.0650E-03  5.3483E-01
140047  SR        SR-90     2.8980E-02  6.1814E-01
141049  SR        SR-90     1.7290E-02  6.1380E-01
142050  SR        SR-90     7.2600E-02  5.8879E-01
143042  SR        SR-90     3.6960E-02  6.7452E-01
145040  SR        SR-90     6.7200E-02  3.6960E-01
148039  SR        SR-90     1.7150E-01  3.4300E-01
150056  SR        SR-90     8.3200E-03  6.0736E-02

        AREA 1    NATURAL NUCLIDES

136048  GAMMA     BE-7      1.0528E-01  7.2643E-02
101081  GAMMA     BI-214    1.0400E+00  7.2800E-02
102079  GAMMA     BI-214    5.9250E-01  6.5175E-02
103077  GAMMA     BI-214    7.9860E-01  9.5832E-02
105074  GAMMA     BI-214    3.5700E-01  2.4990E-02
106082  GAMMA     BI-214    7.3000E-01  8.7600E-02
107080  GAMMA     BI-214    6.1000E-01  4.2700E-02
108078  GAMMA     BI-214    7.6840E-01  8.4524E-02
109076  GAMMA     BI-214    8.3000E-01  4.9800E-02
111065  GAMMA     BI-214    8.2000E-01  9.0200E-02
112068  GAMMA     BI-214    8.6000E-01  6.8800E-02
113070  GAMMA     BI-214    8.6000E-01  6.8800E-02
114071  GAMMA     BI-214    8.6000E-01  6.8800E-02
115072  GAMMA     BI-214    8.9000E-01  6.2300E-02
116073  GAMMA     BI-214    4.9000E-01  4.4100E-02
118064  GAMMA     BI-214    7.8000E-01  7.0200E-02
119066  GAMMA     BI-214    6.9000E-01  5.5200E-02
120067  GAMMA     BI-214    7.5240E-01  6.7716E-02
121069  GAMMA     BI-214    3.9000E-01  4.6800E-02
122058  GAMMA     BI-214    8.5000E-01  7.6500E-02
123055  GAMMA     BI-214    8.3650E-01  1.0038E-01
124053  GAMMA     BI-214    6.1230E-01  4.2861E-02
125063  GAMMA     BI-214    8.6000E-01  7.7400E-02
126062  GAMMA     BI-214    7.5400E-01  6.7860E-02
127061  GAMMA     BI-214    6.0200E-01  6.0200E-02
127061  GAMMA     BI-214    8.3850E-01  6.7080E-02
128060  GAMMA     BI-214    8.9170E-01  1.0700E-01
129059  GAMMA     BI-214    9.0000E-01  9.0000E-02
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130057	GAMMA	BI-214	9.1020E-01	7.2816E-02
131054	GAMMA	BI-214	8.3000E-01	5.8100E-02
132052	GAMMA	BI-214	8.7120E-01	1.0454E-01
132052	GAMMA	BI-214	8.9760E-01	1.0771E-01
133044	GAMMA	BI-214	8.3000E-01	9.9600E-02
134045	GAMMA	BI-214	1.3288E+00	5.3152E-02
135046	GAMMA	BI-214	1.3205E+00	5.2820E-02
136048	GAMMA	BI-214	7.1680E-01	6.4512E-02
137051	GAMMA	BI-214	7.5950E-01	9.8735E-02
138043	GAMMA	BI-214	7.8000E-01	7.0200E-02
140047	GAMMA	BI-214	7.0380E-01	2.1114E-02
141049	GAMMA	BI-214	7.9040E-01	9.4848E-02
142050	GAMMA	BI-214	7.0180E-01	6.3162E-02
143042	GAMMA	BI-214	7.6230E-01	6.0984E-02
144041	GAMMA	BI-214	6.7000E-01	6.0300E-02
144041	GAMMA	BI-214	7.3000E-01	5.8400E-02
145040	GAMMA	BI-214	5.8240E-01	5.8240E-02
147038	GAMMA	BI-214	7.3800E-01	8.8560E-02
148039	GAMMA	BI-214	7.5950E-01	6.8355E-02
150056	GAMMA	BI-214	7.4880E-01	8.2368E-02
101081	GAMMA	K-40	1.9800E+01	5.9400E-01
102079	GAMMA	K-40	2.0619E+01	6.1857E-01
103077	GAMMA	K-40	1.8876E+01	5.6628E-01
105074	GAMMA	K-40	1.4280E+01	2.8560E-01
106082	GAMMA	K-40	1.8000E+01	1.0800E+00
107080	GAMMA	K-40	2.2000E+01	6.6000E-01
108078	GAMMA	K-40	1.8306E+01	1.0984E+00
109076	GAMMA	K-40	1.8700E+01	5.6100E-01
111065	GAMMA	K-40	1.7700E+01	1.0620E+00
112068	GAMMA	K-40	2.0200E+01	6.0600E-01
113070	GAMMA	K-40	2.2300E+01	8.9200E-01
114071	GAMMA	K-40	2.0700E+01	6.2100E-01
115072	GAMMA	K-40	2.1600E+01	6.4800E-01
116073	GAMMA	K-40	1.3900E+01	5.5600E-01
118064	GAMMA	K-40	1.9500E+01	7.8000E-01
119066	GAMMA	K-40	1.7250E+01	6.9000E-01
120067	GAMMA	K-40	2.0292E+01	8.1168E-01
121069	GAMMA	K-40	2.0200E+01	1.2120E+00
122058	GAMMA	K-40	2.2250E+01	8.9000E-01
123055	GAMMA	K-40	1.9837E+01	1.1902E+00
124053	GAMMA	K-40	1.7270E+01	5.1810E-01
125063	GAMMA	K-40	2.2600E+01	9.0400E-01
126062	GAMMA	K-40	2.0020E+01	6.0060E-01
127061	GAMMA	K-40	2.1500E+01	6.4500E-01
127061	GAMMA	K-40	2.1500E+01	6.4500E-01
128060	GAMMA	K-40	1.8075E+01	1.2652E+00
129059	GAMMA	K-40	1.9400E+01	1.1640E+00
130057	GAMMA	K-40	2.0424E+01	8.1696E-01
131054	GAMMA	K-40	1.9500E+01	5.8500E-01
132052	GAMMA	K-40	2.0856E+01	1.2514E+00
132052	GAMMA	K-40	2.1120E+01	1.2672E+00
133044	GAMMA	K-40	1.9800E+01	1.1880E+00
134045	GAMMA	K-40	2.7180E+01	5.4360E-01
135046	GAMMA	K-40	2.6410E+01	5.2820E-01
136048	GAMMA	K-40	2.0384E+01	6.1152E-01

137051	GAMMA	K-40	1.9355E+01	1.1613E+00
138043	GAMMA	K-40	1.8500E+01	1.1100E+00
140047	GAMMA	K-40	2.0700E+01	4.1400E-01
141049	GAMMA	K-40	1.9019E+01	1.1411E+00
142050	GAMMA	K-40	2.1054E+01	1.2632E+00
143042	GAMMA	K-40	2.0328E+01	6.0984E-01
144041	GAMMA	K-40	1.8750E+01	7.5000E-01
144041	GAMMA	K-40	1.8960E+01	7.5840E-01
145040	GAMMA	K-40	2.0160E+01	6.0480E-01
147038	GAMMA	K-40	1.9000E+01	1.1400E+00
148039	GAMMA	K-40	2.0335E+01	8.1340E-01
150056	GAMMA	K-40	1.8928E+01	9.4640E-01
102079	PB	PB-210	5.1552E+00	1.2849E+00
105074	PB	PB-210	2.8817E+00	1.1595E+00
122058	PB	PB-210	3.2867E+00	1.1043E+00
127061	PB	PB-210	3.4532E+00	1.3828E+00
127061	PB	PB-210	5.2395E+00	1.9778E+00
136048	PB	PB-210	5.9210E-01	7.8177E-01
145040	PB	PB-210	4.2130E+00	1.1240E+00
148039	PB	PB-210	3.5252E+00	1.3490E+00
101081	GAMMA	PB-214	1.0900E+00	6.5400E-02
102079	GAMMA	PB-214	7.1100E-01	6.3990E-02
103077	GAMMA	PB-214	7.9860E-01	7.9860E-02
105074	GAMMA	PB-214	3.5700E-01	2.8560E-02
106082	GAMMA	PB-214	8.0000E-01	7.2000E-02
107080	GAMMA	PB-214	6.9000E-01	2.7600E-02
108078	GAMMA	PB-214	8.1360E-01	7.3224E-02
109076	GAMMA	PB-214	8.5000E-01	5.1000E-02
111065	GAMMA	PB-214	8.2000E-01	8.2000E-02
112068	GAMMA	PB-214	8.4000E-01	5.8800E-02
113070	GAMMA	PB-214	9.1000E-01	7.2800E-02
114071	GAMMA	PB-214	9.0000E-01	6.3000E-02
115072	GAMMA	PB-214	9.3000E-01	5.5800E-02
116073	GAMMA	PB-214	5.2000E-01	4.6800E-02
118064	GAMMA	PB-214	8.8000E-01	6.1600E-02
119066	GAMMA	PB-214	7.0000E-01	6.3000E-02
120067	GAMMA	PB-214	7.9800E-01	7.9800E-02
121069	GAMMA	PB-214	8.8000E-01	9.6800E-02
122058	GAMMA	PB-214	9.0000E-01	6.3000E-02
123055	GAMMA	PB-214	9.3210E-01	8.3889E-02
124053	GAMMA	PB-214	6.5940E-01	5.2752E-02
125063	GAMMA	PB-214	8.8000E-01	7.9200E-02
126062	GAMMA	PB-214	7.8000E-01	5.4600E-02
127061	GAMMA	PB-214	7.3100E-01	5.8480E-02
127061	GAMMA	PB-214	8.8150E-01	5.2890E-02
128060	GAMMA	PB-214	1.0122E+00	9.1098E-02
129059	GAMMA	PB-214	9.4000E-01	8.4600E-02
130057	GAMMA	PB-214	9.9900E-01	7.9920E-02
131054	GAMMA	PB-214	8.3000E-01	5.8100E-02
132052	GAMMA	PB-214	8.9760E-01	8.9760E-02
132052	GAMMA	PB-214	9.2400E-01	9.2400E-02
133044	GAMMA	PB-214	8.5000E-01	9.3500E-02
134045	GAMMA	PB-214	1.3439E+00	5.3756E-02
135046	GAMMA	PB-214	1.3483E+00	5.3932E-02
136048	GAMMA	PB-214	8.0640E-01	6.4512E-02

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137051   GAMMA     PB-214     7.3500E-01   7.3500E-02
138043   GAMMA     PB-214     8.3000E-01   8.3000E-02
140047   GAMMA     PB-214     7.1760E-01   2.8704E-02
141049   GAMMA     PB-214     8.1510E-01   8.1510E-02
142050   GAMMA     PB-214     7.2600E-01   7.2600E-02
143042   GAMMA     PB-214     7.6230E-01   4.5738E-02
144041   GAMMA     PB-214     7.5000E-01   6.0000E-02
144041   GAMMA     PB-214     7.5000E-01   6.7500E-02
145040   GAMMA     PB-214     6.4960E-01   5.8464E-02
147038   GAMMA     PB-214     7.8600E-01   7.8600E-02
148039   GAMMA     PB-214     7.8400E-01   6.2720E-02
150056   GAMMA     PB-214     7.2800E-01   6.5520E-02
102079   PO        PO-210     2.9884E+00   4.6866E-01
105074   PO        PO-210     1.5354E+00   2.7800E-01
122058   PO        PO-210     3.2586E+00   5.2767E-01
127061   PO        PO-210     2.4465E+00   4.0085E-01
127061   PO        PO-210     2.5020E+00   4.1725E-01
136048   PO        PO-210     1.7387E+00   3.0719E-01
145040   PO        PO-210     2.3790E+00   3.8950E-01
148039   PO        PO-210     2.6168E+00   4.3269E-01
102079   RA        RA-226     1.1850E+00   4.7400E-02
103077   RA        RA-226     1.0406E+00   4.1624E-02
105074   RA        RA-226     4.6410E-01   3.2487E-02
108078   RA        RA-226     9.9440E-01   3.9776E-02
119066   RA        RA-226     8.4000E-01   4.2000E-02
120067   RA        RA-226     1.0488E+00   5.2440E-02
122058   RA        RA-226     1.0000E+00   4.0000E-02
123055   RA        RA-226     9.7990E-01   4.8995E-02
124053   RA        RA-226     9.7340E-01   4.8670E-02
126062   RA        RA-226     7.5400E-01   3.7700E-02
127061   RA        RA-226     1.0750E+00   4.3000E-02
127061   RA        RA-226     8.6000E-01   4.3000E-02
128060   RA        RA-226     1.0122E+00   5.0610E-02
130057   RA        RA-226     1.3320E+00   5.3280E-02
132052   RA        RA-226     1.0032E+00   5.0160E-02
132052   RA        RA-226     9.2400E-01   4.6200E-02
134045   RA        RA-226     1.8422E+00   7.3688E-02
135046   RA        RA-226     1.7792E+00   7.1168E-02
136048   RA        RA-226     1.1200E+00   4.4800E-02
137051   RA        RA-226     7.5950E-01   3.7975E-02
140047   RA        RA-226     1.0074E+00   5.0370E-02
141049   RA        RA-226     8.6450E-01   4.3225E-02
142050   RA        RA-226     9.4380E-01   4.7190E-02
143042   RA        RA-226     4.6200E-01   3.2340E-02
145040   RA        RA-226     8.9600E-01   4.4800E-02
148039   RA        RA-226     9.8000E-01   3.9200E-02
150056   RA        RA-226     9.3600E-01   4.6800E-02
102079   TH        TH-227     1.3265E-01   4.9960E-02
103077   TH        TH-227     2.7830E-01   6.7397E-02
105074   TH        TH-227     5.5168E-02   3.9044E-02
108078   TH        TH-227     3.2069E-01   7.8806E-02
119066   TH        TH-227     1.0650E-01   3.8930E-02
120067   TH        TH-227     2.2937E-01   6.9472E-02
122058   TH        TH-227     5.9775E-01   9.7550E-02
123055   TH        TH-227     1.2196E-01   4.4550E-02
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124053  TH          TH-227    1.8777E-01  5.8859E-02
126062  TH          TH-227    2.3065E-01  6.7522E-02
127061  TH          TH-227    5.5793E-01  1.0019E-01
130057  TH          TH-227    1.8597E-01  5.2703E-02
132052  TH          TH-227    1.9745E-01  5.5519E-02
132052  TH          TH-227    2.3287E-01  5.9954E-02
134045  TH          TH-227    3.0336E-01  7.6180E-02
135046  TH          TH-227    2.3269E-01  6.0354E-02
136048  TH          TH-227    4.1597E-01  8.2656E-02
140047  TH          TH-227    2.4081E-01  6.3577E-02
141049  TH          TH-227    1.6616E-01  4.8684E-02
142050  TH          TH-227    1.0307E-01  3.7123E-02
143042  TH          TH-227    1.3058E-01  4.2527E-02
145040  TH          TH-227    2.1334E-01  6.2586E-02
150056  TH          TH-227    2.1195E-01  5.6451E-02
102079  TH          TH-228    9.3828E-01  9.6483E-02
103077  TH          TH-228    1.0050E+00  9.6147E-02
105074  TH          TH-228    4.3292E-01  7.1186E-02
108078  TH          TH-228    1.0491E+00  1.0624E-01
119066  TH          TH-228    9.2690E-01  8.8230E-02
120067  TH          TH-228    1.1395E+00  1.1797E-01
122058  TH          TH-228    1.0317E+00  9.8775E-02
123055  TH          TH-228    9.7345E-01  9.3808E-02
124053  TH          TH-228    7.5297E-01  9.0495E-02
126062  TH          TH-228    1.0343E+00  1.0587E-01
127061  TH          TH-228    1.1485E+00  1.0976E-01
130057  TH          TH-228    1.1819E+00  9.8768E-02
132052  TH          TH-228    8.9047E-01  8.8783E-02
132052  TH          TH-228    9.7786E-01  9.2770E-02
134045  TH          TH-228    1.3463E+00  1.1864E-01
135046  TH          TH-228    1.2397E+00  1.0500E-01
136048  TH          TH-228    1.2423E+00  1.1077E-01
140047  TH          TH-228    1.5428E+00  1.2423E-01
141049  TH          TH-228    1.0880E+00  9.5070E-02
142050  TH          TH-228    7.5431E-01  7.7464E-02
143042  TH          TH-228    1.0413E+00  9.1476E-02
145040  TH          TH-228    7.5219E-01  9.1213E-02
150056  TH          TH-228    9.8883E-01  9.3184E-02
102079  TH          TH-230    1.1608E+00  1.0184E-01
103077  TH          TH-230    1.0992E+00  9.5421E-02
105074  TH          TH-230    3.6414E-01  5.8239E-02
108078  TH          TH-230    1.0911E+00  1.0403E-01
119066  TH          TH-230    1.1050E+00  9.0430E-02
120067  TH          TH-230    1.1890E+00  1.1569E-01
122058  TH          TH-230    1.0390E+00  9.2750E-02
123055  TH          TH-230    1.2019E+00  9.9089E-02
124053  TH          TH-230    8.3100E-01  8.8909E-02
126062  TH          TH-230    1.2631E+00  1.1242E-01
127061  TH          TH-230    1.3106E+00  1.1156E-01
130057  TH          TH-230    1.1076E+00  9.1131E-02
132052  TH          TH-230    1.1656E+00  9.6466E-02
132052  TH          TH-230    1.2339E+00  9.9739E-02
134045  TH          TH-230    1.5870E+00  1.2491E-01
135046  TH          TH-230    1.3327E+00  1.0499E-01
136048  TH          TH-230    1.1039E+00  9.8605E-02
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140047	TH	TH-230	1.2991E+00	1.0914E-01
141049	TH	TH-230	1.2422E+00	9.7886E-02
142050	TH	TH-230	1.1091E+00	8.9637E-02
143042	TH	TH-230	1.1631E+00	9.3162E-02
145040	TH	TH-230	1.0595E+00	1.0114E-01
150056	TH	TH-230	1.0951E+00	9.2810E-02
101081	GAMMA	TH-232	8.7000E-01	9.5700E-02
102079	GAMMA	TH-232	8.2950E-01	9.1245E-02
103077	GAMMA	TH-232	8.9540E-01	1.5222E-01
105074	GAMMA	TH-232	5.7120E-01	4.5696E-02
106082	GAMMA	TH-232	9.1000E-01	1.4560E-01
107080	GAMMA	TH-232	8.3000E-01	8.3000E-02
108078	GAMMA	TH-232	7.4580E-01	1.3424E-01
109076	GAMMA	TH-232	8.0000E-01	7.2000E-02
111065	GAMMA	TH-232	8.2000E-01	1.3940E-01
112068	GAMMA	TH-232	8.1000E-01	8.9100E-02
113070	GAMMA	TH-232	1.0000E+00	1.1000E-01
114071	GAMMA	TH-232	9.3000E-01	9.3000E-02
115072	GAMMA	TH-232	8.9000E-01	8.0100E-02
116073	GAMMA	TH-232	5.9000E-01	6.4900E-02
118064	GAMMA	TH-232	8.5000E-01	9.3500E-02
119066	GAMMA	TH-232	7.2000E-01	8.6400E-02
120067	GAMMA	TH-232	8.2080E-01	9.0288E-02
121069	GAMMA	TH-232	8.6000E-01	1.5480E-01
122058	GAMMA	TH-232	9.0000E-01	1.0800E-01
123055	GAMMA	TH-232	8.8430E-01	1.5917E-01
124053	GAMMA	TH-232	6.4370E-01	6.4370E-02
125063	GAMMA	TH-232	9.1000E-01	1.7290E-01
126062	GAMMA	TH-232	8.0600E-01	8.8660E-02
127061	GAMMA	TH-232	7.7400E-01	8.5140E-02
127061	GAMMA	TH-232	8.1700E-01	9.8040E-02
128060	GAMMA	TH-232	9.1580E-01	1.7400E-01
129059	GAMMA	TH-232	7.7000E-01	1.3090E-01
130057	GAMMA	TH-232	9.5460E-01	1.0501E-01
131054	GAMMA	TH-232	8.3000E-01	9.1300E-02
132052	GAMMA	TH-232	1.0032E+00	1.8058E-01
132052	GAMMA	TH-232	9.2400E-01	1.7556E-01
133044	GAMMA	TH-232	8.8000E-01	1.5840E-01
134045	GAMMA	TH-232	1.0570E+00	8.4560E-02
135046	GAMMA	TH-232	1.1259E+00	7.8813E-02
136048	GAMMA	TH-232	1.0080E+00	9.0720E-02
137051	GAMMA	TH-232	7.1050E-01	1.4210E-01
138043	GAMMA	TH-232	7.6000E-01	1.5200E-01
140047	GAMMA	TH-232	8.2800E-01	5.7960E-02
141049	GAMMA	TH-232	9.3860E-01	1.5956E-01
142050	GAMMA	TH-232	8.2280E-01	9.8736E-02
143042	GAMMA	TH-232	8.3160E-01	8.3160E-02
144041	GAMMA	TH-232	7.1000E-01	8.5200E-02
144041	GAMMA	TH-232	8.1000E-01	9.7200E-02
145040	GAMMA	TH-232	7.6160E-01	8.3776E-02
147038	GAMMA	TH-232	8.5700E-01	1.5426E-01
148039	GAMMA	TH-232	9.3100E-01	1.1172E-01
150056	GAMMA	TH-232	6.6560E-01	1.1981E-01
102079	TH	TH-232	1.3353E+00	1.1087E-01
103077	TH	TH-232	1.2252E+00	1.0128E-01

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105074  TH        TH-232     3.7509E-01  5.9131E-02
108078  TH        TH-232     1.1402E+00  1.0554E-01
119066  TH        TH-232     1.0430E+00  8.7530E-02
120067  TH        TH-232     1.4366E+00  1.2675E-01
122058  TH        TH-232     1.1025E+00  9.6050E-02
123055  TH        TH-232     1.2146E+00  9.9544E-02
124053  TH        TH-232     8.2221E-01  8.8407E-02
126062  TH        TH-232     1.2631E+00  1.1224E-01
127061  TH        TH-232     1.3390E+00  1.1292E-01
130057  TH        TH-232     1.1406E+00  9.2263E-02
132052  TH        TH-232     1.2279E+00  9.9290E-02
132052  TH        TH-232     1.2590E+00  1.0087E-01
134045  TH        TH-232     1.4262E+00  1.1783E-01
135046  TH        TH-232     1.2463E+00  1.0055E-01
136048  TH        TH-232     1.2403E+00  1.0548E-01
140047  TH        TH-232     1.3748E+00  1.1172E-01
141049  TH        TH-232     1.2829E+00  9.9788E-02
142050  TH        TH-232     1.1282E+00  9.0266E-02
143042  TH        TH-232     1.2488E+00  9.6951E-02
145040  TH        TH-232     1.0450E+00  1.0035E-01
150056  TH        TH-232     1.2384E+00  9.9112E-02
102079  U         U-234      1.1395E+00  1.6751E-01
103077  U         U-234      8.8064E-01  1.2238E-01
105074  U         U-234      3.7426E-01  6.8246E-02
108078  U         U-234      9.2728E-01  1.2905E-01
120067  U         U-234      1.0746E+00  1.3758E-01
122058  U         U-234      1.1290E+00  1.7495E-01
123055  U         U-234      1.2471E+00  1.6613E-01
124053  U         U-234      6.4323E-01  9.8266E-02
126062  U         U-234      1.1193E+00  1.5613E-01
127061  U         U-234      1.0696E+00  1.4194E-01
128060  U         U-234      2.2391E+00  2.9884E-01
130057  U         U-234      1.6526E+00  2.1086E-01
132052  U         U-234      1.1510E+00  1.5449E-01
132052  U         U-234      1.1880E+00  1.5346E-01
134045  U         U-234      1.0331E+00  1.4100E-01
135046  U         U-234      1.4011E+00  1.7959E-01
136048  U         U-234      1.2562E+00  1.7638E-01
137051  U         U-234      1.1067E+00  1.4408E-01
140047  U         U-234      1.0938E+00  1.4407E-01
141049  U         U-234      1.3024E+00  1.7510E-01
142050  U         U-234      1.2441E+00  1.8034E-01
143042  U         U-234      1.1247E+00  1.4708E-01
145040  U         U-234      9.4282E-01  1.3924E-01
148039  U         U-234      9.4937E-01  1.4720E-01
150056  U         U-234      2.2547E+00  2.5917E-01
102079  U         U-235      6.3326E-02  2.4932E-02
103077  U         U-235      4.3657E-02  1.9808E-02
105074  U         U-235      6.5081E-03  7.6160E-03
108078  U         U-235      3.5233E-02  1.7917E-02
120067  U         U-235      2.7428E-02  1.4822E-02
122058  U         U-235      2.2840E-02  1.6365E-02
123055  U         U-235      8.5921E-02  3.0281E-02
124053  U         U-235      5.9990E-02  2.3628E-02
126062  U         U-235      3.0862E-02  1.7516E-02
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127061  U          U-235       5.9319E-02  2.4231E-02
128060  U          U-235       1.3858E-01  4.2223E-02
130057  U          U-235       7.5280E-02  2.8394E-02
132052  U          U-235       3.6775E-02  1.7992E-02
132052  U          U-235       3.7118E-02  1.8240E-02
134045  U          U-235       4.5511E-02  2.1714E-02
135046  U          U-235       2.8537E-02  1.6388E-02
136048  U          U-235       5.4678E-02  2.3632E-02
137051  U          U-235       4.2948E-02  1.9176E-02
140047  U          U-235       1.0469E-01  3.2720E-02
141049  U          U-235       7.8373E-02  2.8850E-02
142050  U          U-235       7.3011E-02  2.9234E-02
143042  U          U-235       1.2987E-01  3.5158E-02
145040  U          U-235       5.9987E-02  2.3318E-02
148039  U          U-235       2.3375E-02  1.6586E-02
150056  U          U-235       6.0674E-02  2.4315E-02
108078  GAMMA      U-238       4.0680E+00  4.3934E+00
114071  GAMMA      U-238       2.4000E+00  2.9040E+00
116073  GAMMA      U-238       2.1000E+00  2.0580E+00
119066  GAMMA      U-238       2.6400E+00  2.5080E+00
121069  GAMMA      U-238       5.8000E+00  4.9300E+00
123055  GAMMA      U-238       6.2140E+00  4.6605E+00
132052  GAMMA      U-238       4.7520E+00  2.5186E+00
134045  GAMMA      U-238       1.8120E+00  2.8811E+00
136048  GAMMA      U-238       3.1360E+00  2.6970E+00
143042  GAMMA      U-238       2.7720E+00  3.2155E+00
102079  U          U-238       1.2030E+00  1.7514E-01
103077  U          U-238       1.0169E+00  1.3668E-01
105074  U          U-238       3.2558E-01  6.2439E-02
108078  U          U-238       8.3258E-01  1.1906E-01
120067  U          U-238       9.0835E-01  1.2089E-01
122058  U          U-238       9.2425E-01  1.4845E-01
123055  U          U-238       1.1054E+00  1.5117E-01
124053  U          U-238       9.4859E-01  1.3018E-01
126062  U          U-238       1.0062E+00  1.4386E-01
127061  U          U-238       1.0410E+00  1.3887E-01
128060  U          U-238       1.8328E+00  2.5185E-01
130057  U          U-238       1.4779E+00  1.9239E-01
132052  U          U-238       1.0175E+00  1.3628E-01
132052  U          U-238       1.1413E+00  1.5370E-01
134045  U          U-238       8.5647E-01  1.2234E-01
135046  U          U-238       1.1274E+00  1.5123E-01
136048  U          U-238       1.1001E+00  1.5779E-01
137051  U          U-238       9.4693E-01  1.2772E-01
140047  U          U-238       1.0532E+00  1.3938E-01
141049  U          U-238       1.0441E+00  1.4689E-01
142050  U          U-238       1.2468E+00  1.8031E-01
143042  U          U-238       1.1488E+00  1.4890E-01
145040  U          U-238       9.7978E-01  1.4345E-01
148039  U          U-238       9.2365E-01  1.4401E-01
150056  U          U-238       1.0030E+00  1.3337E-01

        AREA 1     GROSS ALPHA

101081  ALPHA      ALPHA       4.4000E+00  1.8480E+00
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102079  ALPHA      ALPHA      1.4400E+01  2.7360E+00
103077  ALPHA      ALPHA      1.2700E+01  3.5560E+00
105074  ALPHA      ALPHA      7.6000E+00  2.2040E+00
106082  ALPHA      ALPHA      6.4000E+00  2.3040E+00
107080  ALPHA      ALPHA      7.3000E+00  2.3360E+00
108078  ALPHA      ALPHA      1.1000E+01  2.4200E+00
109076  ALPHA      ALPHA      6.0000E+00  2.1000E+00
111065  ALPHA      ALPHA      6.7000E+00  2.3450E+00
112068  ALPHA      ALPHA      2.9000E+00  1.5950E+00
113070  ALPHA      ALPHA      4.4000E+00  2.0240E+00
113070  ALPHA      ALPHA      4.9000E+00  1.9600E+00
114071  ALPHA      ALPHA      1.0200E+01  2.4480E+00
115072  ALPHA      ALPHA      1.3000E+00  1.4040E+00
116073  ALPHA      ALPHA      4.4000E+00  1.5400E+00
118064  ALPHA      ALPHA      4.8000E+00  1.8720E+00
119066  ALPHA      ALPHA      8.6000E+00  2.2360E+00
120067  ALPHA      ALPHA      1.1300E+01  2.4860E+00
121069  ALPHA      ALPHA      2.8000E+00  1.4280E+00
122058  ALPHA      ALPHA      1.2400E+01  2.8520E+00
123055  ALPHA      ALPHA      7.3000E+00  2.1900E+00
124053  ALPHA      ALPHA      7.7000E+00  2.0790E+00
125063  ALPHA      ALPHA      3.3000E+00  1.6170E+00
126062  ALPHA      ALPHA      7.9000E+00  2.2120E+00
127061  ALPHA      ALPHA      9.1000E+00  2.3660E+00
127061  ALPHA      ALPHA      9.2000E+00  2.2080E+00
128060  ALPHA      ALPHA      1.0900E+01  2.3980E+00
129059  ALPHA      ALPHA      4.1000E+00  1.8450E+00
130057  ALPHA      ALPHA      1.1400E+01  2.6220E+00
131054  ALPHA      ALPHA      1.0600E+01  2.4380E+00
132052  ALPHA      ALPHA      1.0400E+01  2.3920E+00
132052  ALPHA      ALPHA      1.0600E+01  2.4380E+00
133044  ALPHA      ALPHA      5.6000E+00  2.0160E+00
134045  ALPHA      ALPHA      1.1900E+01  2.4990E+00
135046  ALPHA      ALPHA      8.4000E+00  2.3520E+00
136048  ALPHA      ALPHA      1.2800E+01  2.8160E+00
137051  ALPHA      ALPHA      1.1800E+01  2.7140E+00
138043  ALPHA      ALPHA      3.5000E+00  1.5400E+00
140047  ALPHA      ALPHA      1.2400E+01  2.7280E+00
141049  ALPHA      ALPHA      1.6200E+01  2.9160E+00
142050  ALPHA      ALPHA      1.4800E+01  2.8120E+00
143042  ALPHA      ALPHA      9.8000E+00  2.3520E+00
144041  ALPHA      ALPHA      3.4000E+00  1.6660E+00
144041  ALPHA      ALPHA      8.3000E+00  2.2410E+00
145040  ALPHA      ALPHA      9.0000E+00  2.2500E+00
147038  ALPHA      ALPHA      6.0000E+00  2.2800E+00
148039  ALPHA      ALPHA      8.3000E+00  2.2410E+00
150056  ALPHA      ALPHA      1.2800E+01  2.6880E+00

        AREA 1     GROSS BETA

101081  BETA       BETA       4.0900E+01  2.0450E+00
102079  BETA       BETA       4.9600E+01  2.4800E+00
103077  BETA       BETA       1.2500E+01  6.2500E-01
105074  BETA       BETA       1.6700E+01  1.3360E+00
106082  BETA       BETA       4.1800E+01  2.0900E+00
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107080  BETA      BETA      3.7500E+01  1.8750E+00
108078  BETA      BETA      4.1500E+01  2.0750E+00
109076  BETA      BETA      3.9800E+01  1.9900E+00
111065  BETA      BETA      4.1800E+01  2.0900E+00
112068  BETA      BETA      4.0700E+01  2.0350E+00
113070  BETA      BETA      4.0400E+01  2.0200E+00
113070  BETA      BETA      4.1700E+01  2.0850E+00
114071  BETA      BETA      4.6700E+01  2.3350E+00
115072  BETA      BETA      4.3800E+01  2.1900E+00
116073  BETA      BETA      3.0500E+01  1.8300E+00
118064  BETA      BETA      4.0500E+01  2.0250E+00
119066  BETA      BETA      4.5100E+01  2.2550E+00
120067  BETA      BETA      3.9900E+01  1.9950E+00
121069  BETA      BETA      3.1500E+01  1.8900E+00
122058  BETA      BETA      4.0000E+01  2.0000E+00
123055  BETA      BETA      3.2200E+01  1.9320E+00
124053  BETA      BETA      3.2800E+01  1.9680E+00
125063  BETA      BETA      4.3500E+01  2.1750E+00
126062  BETA      BETA      3.3400E+01  2.0040E+00
127061  BETA      BETA      5.0000E+01  2.5000E+00
127061  BETA      BETA      5.0400E+01  2.5200E+00
128060  BETA      BETA      3.6100E+01  1.8050E+00
129059  BETA      BETA      3.0400E+01  1.8240E+00
130057  BETA      BETA      3.7500E+01  1.8750E+00
131054  BETA      BETA      4.1400E+01  2.0700E+00
132052  BETA      BETA      3.0500E+01  1.8300E+00
132052  BETA      BETA      3.1300E+01  1.8780E+00
133044  BETA      BETA      4.1600E+01  2.0800E+00
134045  BETA      BETA      5.1000E+01  2.0400E+00
135046  BETA      BETA      5.0000E+01  2.5000E+00
136048  BETA      BETA      4.7900E+01  2.3950E+00
137051  BETA      BETA      3.8600E+01  1.9300E+00
138043  BETA      BETA      3.9300E+01  1.9650E+00
140047  BETA      BETA      4.0200E+01  2.0100E+00
141049  BETA      BETA      4.4000E+01  2.2000E+00
142050  BETA      BETA      3.3000E+01  1.6500E+00
143042  BETA      BETA      3.7800E+01  1.8900E+00
144041  BETA      BETA      3.4800E+01  1.7400E+00
144041  BETA      BETA      3.9300E+01  1.9650E+00
145040  BETA      BETA      3.9000E+01  1.9500E+00
147038  BETA      BETA      4.2800E+01  2.1400E+00
148039  BETA      BETA      4.1300E+01  2.0650E+00
150056  BETA      BETA      2.9500E+01  1.7700E+00

        AREA 2    MAN-MADE NUCLIDES

224138  GAMMA     CS-134    5.0250E-02  1.7587E-02
203126  GAMMA     CS-137    7.5240E-02  1.8810E-02
205124  GAMMA     CS-137    1.1000E-01  2.3100E-02
206127  GAMMA     CS-137    7.0000E-02  1.9600E-02
209129  GAMMA     CS-137    1.0000E-01  1.8000E-02
211119  GAMMA     CS-137    3.0000E-02  2.9400E-02
214123  GAMMA     CS-137    6.0200E-02  1.8060E-02
214123  GAMMA     CS-137    6.7080E-02  2.4149E-02
215130  GAMMA     CS-137    1.0000E-01  3.0000E-02
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216122	GAMMA	CS-137	4.0000E-02	1.7600E-02
217131	GAMMA	CS-137	9.0000E-02	2.4300E-02
218140	GAMMA	CS-137	8.0000E-02	1.4400E-02
219121	GAMMA	CS-137	1.1600E-02	1.0324E-02
220133	GAMMA	CS-137	6.0000E-02	1.6800E-02
221139	GAMMA	CS-137	6.0000E-02	1.7400E-02
222120	GAMMA	CS-137	3.0000E-02	1.6500E-02
222120	GAMMA	CS-137	4.0000E-02	1.6400E-02
223134	GAMMA	CS-137	2.1060E-02	1.3689E-02
224138	GAMMA	CS-137	8.6430E-02	2.1608E-02
225135	GAMMA	CS-137	4.0000E-02	8.8000E-03
226137	GAMMA	CS-137	6.0000E-02	2.1600E-02
228128	GAMMA	CS-137	4.0000E-02	1.7600E-02
214123	GAMMA	MN-54	8.6000E-03	8.3420E-03
203126	PU	PU-238	1.1516E-02	9.2921E-03
211119	PU	PU-238	3.5230E-02	2.1260E-02
214123	PU	PU-238	4.9639E-03	1.6560E-02
214123	PU	PU-238	6.0097E-03	6.7562E-03
219121	PU	PU-238	1.4169E-02	1.1794E-02
223134	PU	PU-238	1.5406E-02	1.5706E-02
224138	PU	PU-238	6.5345E-05	1.3732E-02
203126	PU	PU-239	3.1284E-02	1.6452E-02
211119	PU	PU-239	2.8250E-02	1.7430E-02
214123	PU	PU-239	2.4820E-02	1.3153E-02
214123	PU	PU-239	2.5662E-02	1.4236E-02
219121	PU	PU-239	4.2297E-04	1.0275E-02
223134	PU	PU-239	2.4608E-02	1.5220E-02
224138	PU	PU-239	3.8793E-02	1.8221E-02
219121	SR	SR-90	4.3500E-02	9.2437E-01
223134	SR	SR-90	6.4800E-02	3.7778E-01

AREA 2 NATURAL NUCLIDES

203126	GAMMA	BI-214	9.1080E-01	5.4648E-02
205124	GAMMA	BI-214	9.2000E-01	6.4400E-02
206127	GAMMA	BI-214	6.3000E-01	5.6700E-02
209129	GAMMA	BI-214	9.2000E-01	5.5200E-02
211119	GAMMA	BI-214	1.5000E+00	9.0000E-02
214123	GAMMA	BI-214	7.2240E-01	5.0568E-02
214123	GAMMA	BI-214	7.3960E-01	4.4376E-02
215130	GAMMA	BI-214	7.6000E-01	7.6000E-02
216122	GAMMA	BI-214	7.1000E-01	4.9700E-02
217131	GAMMA	BI-214	9.7000E-01	6.7900E-02
218140	GAMMA	BI-214	7.8000E-01	4.6800E-02
219121	GAMMA	BI-214	5.9450E-01	3.5670E-02
220133	GAMMA	BI-214	8.1000E-01	4.8600E-02
221139	GAMMA	BI-214	7.5000E-01	5.2500E-02
222120	GAMMA	BI-214	7.6000E-01	3.8000E-02
222120	GAMMA	BI-214	7.9000E-01	3.9500E-02
223134	GAMMA	BI-214	7.2900E-01	4.3740E-02
224138	GAMMA	BI-214	8.2410E-01	5.7687E-02
225135	GAMMA	BI-214	7.0000E-01	3.5000E-02
226137	GAMMA	BI-214	8.3000E-01	4.9800E-02
227136	GAMMA	BI-214	7.3000E-01	6.5700E-02
227136	GAMMA	BI-214	7.6000E-01	6.8400E-02

228128	GAMMA	BI-214	9.5000E-01	5.7000E-02
203126	GAMMA	K-40	1.9800E+01	5.9400E-01
205124	GAMMA	K-40	2.2400E+01	6.7200E-01
206127	GAMMA	K-40	1.8600E+01	7.4400E-01
209129	GAMMA	K-40	2.2400E+01	4.4800E-01
211119	GAMMA	K-40	4.4700E+01	8.9400E-01
214123	GAMMA	K-40	1.8920E+01	5.6760E-01
214123	GAMMA	K-40	1.8920E+01	5.6760E-01
215130	GAMMA	K-40	1.8000E+01	9.0000E-01
216122	GAMMA	K-40	2.1200E+01	6.3600E-01
217131	GAMMA	K-40	2.7100E+01	8.1300E-01
218140	GAMMA	K-40	1.7800E+01	3.5600E-01
219121	GAMMA	K-40	1.5950E+01	3.1900E-01
220133	GAMMA	K-40	1.7200E+01	5.1600E-01
221139	GAMMA	K-40	1.7600E+01	5.2800E-01
222120	GAMMA	K-40	1.5200E+01	4.5600E-01
222120	GAMMA	K-40	1.5200E+01	4.5600E-01
223134	GAMMA	K-40	1.9440E+01	3.8880E-01
224138	GAMMA	K-40	2.0100E+01	6.0300E-01
225135	GAMMA	K-40	1.6400E+01	3.2800E-01
226137	GAMMA	K-40	2.0600E+01	6.1800E-01
227136	GAMMA	K-40	1.5100E+01	7.5500E-01
227136	GAMMA	K-40	1.5200E+01	7.6000E-01
228128	GAMMA	K-40	2.7300E+01	5.4600E-01
219121	PB	PB-210	1.5129E-01	6.1589E-01
223134	PB	PB-210	1.8515E+00	8.2457E-01
203126	GAMMA	PB-214	9.1080E-01	4.5540E-02
205124	GAMMA	PB-214	9.8000E-01	6.8600E-02
206127	GAMMA	PB-214	7.0000E-01	4.9000E-02
209129	GAMMA	PB-214	1.0000E+00	5.0000E-02
211119	GAMMA	PB-214	1.6000E+00	8.0000E-02
214123	GAMMA	PB-214	7.3960E-01	5.1772E-02
214123	GAMMA	PB-214	7.7400E-01	6.1920E-02
215130	GAMMA	PB-214	8.7000E-01	6.9600E-02
216122	GAMMA	PB-214	7.4000E-01	4.4400E-02
217131	GAMMA	PB-214	1.0000E+00	6.0000E-02
218140	GAMMA	PB-214	8.4000E-01	4.2000E-02
219121	GAMMA	PB-214	6.8150E-01	3.4075E-02
220133	GAMMA	PB-214	8.3000E-01	4.1500E-02
221139	GAMMA	PB-214	8.0000E-01	4.0000E-02
222120	GAMMA	PB-214	8.0000E-01	4.0000E-02
222120	GAMMA	PB-214	8.3000E-01	4.1500E-02
223134	GAMMA	PB-214	8.4240E-01	4.2120E-02
224138	GAMMA	PB-214	9.4470E-01	5.6682E-02
225135	GAMMA	PB-214	7.5000E-01	3.0000E-02
226137	GAMMA	PB-214	8.7000E-01	5.2200E-02
227136	GAMMA	PB-214	7.5000E-01	6.0000E-02
227136	GAMMA	PB-214	7.8000E-01	6.2400E-02
228128	GAMMA	PB-214	1.0000E+00	5.0000E-02
219121	PO	PO-210	1.9852E+00	4.1399E-01
223134	PO	PO-210	1.7810E+00	3.1758E-01
203126	RA	RA-226	1.0692E+00	4.2768E-02
211119	RA	RA-226	6.0000E-01	3.6000E-02
214123	RA	RA-226	8.6000E-01	4.3000E-02
214123	RA	RA-226	8.9440E-01	4.4720E-02

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219121  RA       RA-226   1,0150E+00  5,0750E-02
223134  RA       RA-226   9,7200E-01  4,8600E-02
224138  PA       RA-226   1,0452E+00  5,2260E-02
203126  TH       TH-227   1,7440E-01  4,9599E-02
214123  TH       TH-227   1,5681E-01  5,3389E-02
214123  TH       TH-227   2,2291E-01  5,8910E-02
219121  TH       TH-227   1,4950E-01  4,9344E-02
223134  TH       TH-227   1,4624E-01  4,9799E-02
224138  TH       TH-227   2,1467E-01  5,5778E-02
203126  TH       TH-228   8,2823E-01  8,4883E-02
214123  TH       TH-228   8,1081E-01  8,8855E-02
214123  TH       TH-228   8,7772E-01  8,9750E-02
219121  TH       TH-228   7,1688E-01  8,4651E-02
223134  TH       TH-228   8,9732E-01  8,9213E-02
224138  TH       TH-228   1,1216E+00  9,8731E-02
203126  TH       TH-230   8,4051E-01  7,9299E-02
214123  TH       TH-230   7,6970E-01  8,0118E-02
214123  TH       TH-230   8,1167E-01  8,0169E-02
219121  TH       TH-230   6,0175E-01  7,0470E-02
223134  TH       TH-230   8,6184E-01  8,1437E-02
224138  TH       TH-230   1,0816E+00  9,1978E-02
203126  GAMMA    TH-232   9,3060E-01  8,3754E-02
205124  GAMMA    TH-232   9,6000E-01  9,6000E-02
206127  GAMMA    TH-232   7,0000E-01  9,1000E-02
209129  GAMMA    TH-232   1,0000E+00  8,0000E-02
211119  GAMMA    TH-232   1,7000E+00  1,3600E-01
214123  GAMMA    TH-232   7,9120E-01  7,1208E-02
214123  GAMMA    TH-232   8,0840E-01  7,2756E-02
215130  GAMMA    TH-232   8,0000E-01  1,2800E-01
216122  GAMMA    TH-232   8,3000E-01  7,4700E-02
217131  GAMMA    TH-232   1,1000E+00  9,9000E-02
218140  GAMMA    TH-232   8,0000E-01  6,4000E-02
219121  GAMMA    TH-232   7,5400E-01  5,2780E-02
220133  GAMMA    TH-232   9,0000E-01  7,2000E-02
221139  GAMMA    TH-232   7,8000E-01  7,0200E-02
222120  GAMMA    TH-232   7,6000E-01  6,0800E-02
222120  GAMMA    TH-232   7,6000E-01  6,0800E-02
223134  GAMMA    TH-232   8,7480E-01  6,1236E-02
224138  GAMMA    TH-232   9,2460E-01  1,0171E-01
225135  GAMMA    TH-232   7,2000E-01  5,0400E-02
226137  GAMMA    TH-232   8,4000E-01  7,5600E-02
227136  GAMMA    TH-232   6,3000E-01  1,0080E-01
227136  GAMMA    TH-232   7,5000E-01  1,0500E-01
228128  GAMMA    TH-232   1,1000E+00  7,7000E-02
203126  TH       TH-232   1,1569E+00  9,4624E-02
214123  TH       TH-232   9,5064E-01  8,7307E-02
214123  TH       TH-232   9,7851E-01  9,0919E-02
219121  TH       TH-232   8,0402E-01  8,1635E-02
223134  TH       TH-232   9,7783E-01  8,7302E-02
224138  TH       TH-232   1,2293E+00  9,8872E-02
203126  U        U-234    1,1947E+00  1,6113E-01
211119  U        U-234    6,3090E-01  1,0980E-01
214123  U        U-234    3,4159E-01  8,0651E-02
214123  U        U-234    5,9392E-01  9,7232E-02
219121  U        U-234    5,1113E-01  8,1374E-02
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223134  U        U-234     8.9246E-01  1.3161E-01
224138  U        U-234     1.1803E+00  1.4476E-01
203126  U        U-235     5.0470E-02  2.4552E-02
211119  U        U-235     3.7020E-02  2.1220E-02
214123  U        U-235     1.3256E-01  4.6302E-02
214123  U        U-235     2.9876E-02  1.8524E-02
219121  U        U-235     4.0441E-02  1.7995E-02
223134  U        U-235     5.1775E-02  2.1368E-02
224138  U        U-235     3.7627E-02  1.8428E-02
203126  GAMMA    U-238     2.7720E+00  2.7166E+00
205124  GAMMA    U-238     3.1000E+00  2.3870E+00
222120  GAMMA    U-238     2.3000E+00  1.5640E+00
223134  GAMMA    U-238     2.5920E+00  1.6848E+00
226137  GAMMA    U-238     3.8000E+00  2.2800E-01
203126  U        U-238     1.0985E+00  1.5115E-01
211119  U        U-238     5.3300E-01  9.7990E-02
214123  U        U-238     5.4730E-01  1.0943E-01
214123  U        U-238     7.9825E-01  1.2033E-01
219121  U        U-238     5.8827E-01  8.9915E-02
223134  U        U-238     7.8926E-01  1.1931E-01
224138  U        U-238     9.9334E-01  1.2631E-01

        AREA 2   GROSS ALPHA

203126  ALPHA    ALPHA     8.6000E+00  2.3220E+00
205124  ALPHA    ALPHA     1.1000E+00  1.4080E+00
206127  ALPHA    ALPHA     2.0000E+00  1.3600E+00
209129  ALPHA    ALPHA     8.5000E+00  2.4650E+00
211119  ALPHA    ALPHA     1.1500E+01  2.5300E+00
214123  ALPHA    ALPHA     8.8000E+00  2.3760E+00
214123  ALPHA    ALPHA     9.0000E+00  2.3400E+00
215130  ALPHA    ALPHA     1.0600E+01  2.5440E+00
216122  ALPHA    ALPHA     1.0400E+01  2.4960E+00
217131  ALPHA    ALPHA     4.3000E+00  1.8490E+00
218140  ALPHA    ALPHA     9.0000E+00  2.3400E+00
219121  ALPHA    ALPHA     6.7000E+00  2.1440E+00
220133  ALPHA    ALPHA     5.9000E+00  2.2420E+00
221139  ALPHA    ALPHA     3.8000E+00  1.9760E+00
222120  ALPHA    ALPHA     3.4000E+00  1.6660E+00
222120  ALPHA    ALPHA     3.8000E+00  1.5580E+00
223134  ALPHA    ALPHA     9.1000E+00  2.3660E+00
224138  ALPHA    ALPHA     1.1000E+01  2.5300E+00
225135  ALPHA    ALPHA     1.2100E+01  2.6620E+00
226137  ALPHA    ALPHA     6.1000E+00  2.0740E+00
227136  ALPHA    ALPHA     2.0000E+00  1.5000E+00
227136  ALPHA    ALPHA     2.9000E+00  1.4790E+00
228128  ALPHA    ALPHA     7.6000E+00  2.2800E+00

        AREA 2   GROSS BETA

203126  BETA     BETA      3.5500E+01  1.7750E+00
205124  BETA     BETA      3.8900E+01  1.9450E+00
206127  BETA     BETA      3.8400E+01  1.9200E+00
209129  BETA     BETA      4.1900E+01  2.0950E+00
211119  BETA     BETA      3.7400E+01  1.8700E+00
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214123	BETA	BETA	3.2400E+01	1.9440E+00
214123	BETA	BETA	3.4400E+01	1.7200E+00
215130	BETA	BETA	2.6700E+01	1.6020E+00
216122	BETA	BETA	2.9000E+01	1.7400E+00
217131	BETA	BETA	3.6400E+01	1.8200E+00
218140	BETA	BETA	3.9600E+01	1.9800E+00
219121	BETA	BETA	3.7400E+01	1.8700E+00
220133	BETA	BETA	3.7900E+01	1.8950E+00
221139	BETA	BETA	3.9100E+01	1.9550E+00
222120	BETA	BETA	2.5900E+01	1.5540E+00
222120	BETA	BETA	4.4700E+01	2.2350E+00
223134	BETA	BETA	4.8400E+01	1.9360E+00
224138	BETA	BETA	3.7200E+01	1.8600E+00
225135	BETA	BETA	3.1300E+01	1.8780E+00
226137	BETA	BETA	3.0000E+01	1.8000E+00
227136	BETA	BETA	3.4200E+01	2.0520E+00
227136	BETA	BETA	3.5700E+01	2.1420E+00
228128	BETA	BETA	3.5600E+01	1.7800E+00

AREA 3 MAN-MADE NUCLIDES

303116	GAMMA	CS-137	8.0000E-02	2.2400E-02
305113	GAMMA	CS-137	9.0000E-02	2.6100E-02
305113	GAMMA	CS-137	9.0000E-02	2.6100E-02
306115	GAMMA	CS-137	9.9640E-02	2.3914E-02
309114	GAMMA	CS-137	8.0000E-02	2.1600E-02
312105	GAMMA	CS-137	5.0190E-01	1.9574E-01
316097	GAMMA	CS-137	2.8000E-02	1.7080E-02
316097	GAMMA	CS-137	3.0000E-02	1.8900E-02
319098	GAMMA	CS-137	3.0000E-02	9.0000E-04
320096	GAMMA	CS-137	1.1000E-01	2.4200E-02
323099	GAMMA	CS-137	1.3000E-01	3.5100E-02
324100	GAMMA	CS-137	9.0620E-02	2.1749E-02
326102	GAMMA	CS-137	9.0000E-02	1.7100E-02
328101	GAMMA	CS-137	7.0500E-02	1.7625E-02
306115	GAMMA	MN-54	1.4840E-02	1.1278E-02
306115	PU	PU-238	1.1516E-02	1.2031E-02
312105	PU	PU-238	3.2289E-02	1.9545E-02
316097	PU	PU-238	1.1628E-03	1.6934E-02
316097	PU	PU-238	1.4988E-03	1.0516E-02
324100	PU	PU-238	9.6904E-03	1.6491E-02
328101	PU	PU-238	4.2638E-03	1.2868E-02
306115	PU	PU-239	4.0174E-02	1.9678E-02
312105	PU	PU-239	2.5310E-02	1.5289E-02
316097	PU	PU-239	3.2940E-02	1.5788E-02
316097	PU	PU-239	4.7840E-02	2.0120E-02
324100	PU	PU-239	2.8427E-02	1.7756E-02
328101	PU	PU-239	1.6596E-02	1.1809E-02
316097	SR	SR-90	1.4000E-01	2.1000E-01
316097	SR	SR-90	2.0000E-02	1.2000E-01
328101	SR	SR-90	5.6400E-02	3.2881E-01

AREA 3 NATURAL NUCLIDES

303116	GAMMA	BI-214	8.3000E-01	5.8100E-02

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305113  GAMMA    BI-214    7.0000E-01  7.0000E-02
305113  GAMMA    BI-214    7.4000E-01  7.4000E-02
306115  GAMMA    BI-214    8.6920E-01  6.0844E-02
309114  GAMMA    BI-214    7.6000E-01  4.5600E-02
312105  GAMMA    BI-214    8.6040E-01  6.0228E-02
316097  GAMMA    BI-214    6.4000E-01  5.1200E-02
316097  GAMMA    BI-214    6.6000E-01  5.2800E-02
317104  GAMMA    BI-214    4.3000E-01  2.5800E-02
319098  GAMMA    BI-214    5.9000E-01  3.5400E-02
320096  GAMMA    BI-214    7.8000E-01  6.2400E-02
323099  GAMMA    BI-214    1.0600E+00  9.5400E-02
324100  GAMMA    BI-214    8.4710E-01  5.9297E-02
326102  GAMMA    BI-214    7.4000E-01  3.0000E-02
328101  GAMMA    BI-214    6.6270E-01  5.3016E-02
303116  GAMMA    K-40      1.8500E+01  5.5500E-01
305113  GAMMA    K-40      1.5500E+01  9.3000E-01
305113  GAMMA    K-40      1.5700E+01  7.8500E-01
306115  GAMMA    K-40      2.0776E+01  6.2328E-01
309114  GAMMA    K-40      1.8500E+01  5.5500E-01
312105  GAMMA    K-40      2.6290E+01  7.8870E-01
316097  GAMMA    K-40      2.0000E+01  4.0000E-01
316097  GAMMA    K-40      2.0000E+01  4.0000E-01
317104  GAMMA    K-40      1.4600E+01  2.9200E-01
319098  GAMMA    K-40      1.6900E+01  3.3800E-01
320096  GAMMA    K-40      1.9600E+01  7.8400E-01
323099  GAMMA    K-40      3.3800E+01  1.3520E+00
324100  GAMMA    K-40      2.3640E+01  7.0920E-01
326102  GAMMA    K-40      2.5000E+01  5.0000E-01
328101  GAMMA    K-40      1.9740E+01  7.8960E-01
316097  PB       PB-210    1.0878E+00  7.6116E-01
316097  PB       PB-210    1.3744E+00  8.4361E-01
328101  PB       PB-210    2.3116E+00  1.1386E+00
303116  GAMMA    PB-214    8.9000E-01  5.3400E-02
305113  GAMMA    PB-214    7.4000E-01  6.6600E-02
305113  GAMMA    PB-214    7.6000E-01  6.8400E-02
306115  GAMMA    PB-214    9.5400E-01  7.6320E-02
309114  GAMMA    PB-214    7.8000E-01  6.2400E-02
312105  GAMMA    PB-214    8.8430E-01  5.3058E-02
316097  GAMMA    PB-214    7.2000E-01  5.0400E-02
316097  GAMMA    PB-214    7.2000E-01  5.0400E-02
317104  GAMMA    PB-214    4.2000E-01  2.5200E-02
319098  GAMMA    PB-214    6.2000E-01  3.7200E-02
320096  GAMMA    PB-214    8.4000E-01  6.7200E-02
323099  GAMMA    PB-214    1.0300E+00  8.2400E-02
324100  GAMMA    PB-214    8.6680E-01  6.9344E-02
326102  GAMMA    PB-214    7.6000E-01  4.5600E-02
328101  GAMMA    PB-214    6.9090E-01  4.1454E-02
316097  PO       PO-210    1.9406E+00  3.6155E-01
316097  PO       PO-210    2.2219E+00  4.5625E-01
328101  PO       PO-210    1.4616E+00  2.4480E-01
306115  RA       RA-226    1.0388E+00  4.1552E-02
312105  RA       RA-226    7.8870E-01  3.9435E-02
316097  RA       RA-226    1.0000E+00  4.0000E-02
316097  RA       RA-226    1.2000E+00  4.8000E-02
324100  RA       RA-226    9.6530E-01  4.8265E-02
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328101	RA	RA-226	9.8700E-01	4.9350E-02
306115	TH	TH-227	2.4316E-01	6.9027E-02
312105	TH	TH-227	1.7492E-01	5.3560E-02
316097	TH	TH-227	2.2440E-01	6.3140E-02
316097	TH	TH-227	3.1360E-01	7.8920E-02
324100	TH	TH-227	2.1315E-01	5.5396E-02
328101	TH	TH-227	9.6500E-02	3.7929E-02
306115	TH	TH-228	1.0534E+00	1.0789E-01
312105	TH	TH-228	9.4142E-01	9.5289E-02
316097	TH	TH-228	1.0890E+00	1.1014E-01
316097	TH	TH-228	1.2450E+00	1.1424E-01
324100	TH	TH-228	1.0662E+00	9.7121E-02
328101	TH	TH-228	7.5491E-01	8.4233E-02
306115	TH	TH-230	1.1327E+00	1.0568E-01
312105	TH	TH-230	8.6566E-01	8.5514E-02
316097	TH	TH-230	1.2458E+00	1.0732E-01
316097	TH	TH-230	1.3658E+00	1.1876E-01
324100	TH	TH-230	1.1117E+00	9.4225E-02
328101	TH	TH-230	8.1554E-01	7.9792E-02
303116	GAMMA	TH-232	8.9000E-01	8.0100E-02
305113	GAMMA	TH-232	7.8000E-01	1.1700E-01
305113	GAMMA	TH-232	8.0000E-01	1.2000E-01
306115	GAMMA	TH-232	9.5400E-01	1.0494E-01
309114	GAMMA	TH-232	8.3000E-01	8.3000E-02
312105	GAMMA	TH-232	9.3210E-01	8.3889E-02
316097	GAMMA	TH-232	9.2000E-01	7.3600E-02
316097	GAMMA	TH-232	9.6000E-01	7.6800E-02
317104	GAMMA	TH-232	4.5000E-01	4.0500E-02
319098	GAMMA	TH-232	5.4000E-01	5.4000E-02
320096	GAMMA	TH-232	9.6000E-01	9.6000E-02
323099	GAMMA	TH-232	1.3000E+00	1.5600E-01
324100	GAMMA	TH-232	9.6530E-01	8.6877E-02
326102	GAMMA	TH-232	9.1000E-01	7.2800E-02
328101	GAMMA	TH-232	7.8960E-01	9.4752E-02
306115	TH	TH-232	1.2321E+00	1.1077E-01
312105	TH	TH-232	9.7775E-01	9.0533E-02
316097	TH	TH-232	1.3748E+00	1.1902E-01
316097	TH	TH-232	1.4712E+00	1.1812E-01
324100	TH	TH-232	1.2413E+00	9.9465E-02
328101	TH	TH-232	9.0818E-01	8.5051E-02
312105	U	U-234	7.4162E-01	1.0232E-01
316097	U	U-234	1.0598E+00	1.5074E-01
316097	U	U-234	1.3078E+00	2.0200E-01
316097	U	U-234	1.3426E+00	1.9232E-01
328101	U	U-234	9.7501E-01	1.3764E-01
312105	U	U-235	4.9999E-02	1.9770E-02
316097	U	U-235	3.9380E-02	1.8186E-02
316097	U	U-235	6.3740E-02	2.9760E-02
316097	U	U-235	6.9840E-02	2.8600E-02
328101	U	U-235	2.5352E-02	1.5298E-02
319098	GAMMA	U-238	1.2000E+00	1.0080E+00
326102	GAMMA	U-238	2.4000E+00	2.0880E+00
328101	GAMMA	U-238	5.7810E+00	3.7576E+00
312105	U	U-238	6.0802E-01	8.8550E-02
316097	U	U-238	1.2210E+00	1.7756E-01

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316097  U        U-238     8.9720E-01  1.4914E-01
316097  U        U-238     9.7660E-01  1.4118E-01
328101  U        U-238     8.7138E-01  1.2590E-01

        AREA 3   GROSS ALPHA

303116  ALPHA    ALPHA     2.6000E+00  1.3780E+00
305113  ALPHA    ALPHA     4.0000E+00  2.0000E+00
305113  ALPHA    ALPHA     7.2000E+00  2.1600E+00
306115  ALPHA    ALPHA     7.7000E+00  2.0790E+00
309114  ALPHA    ALPHA     4.0000E-01  1.3840E+00
312105  ALPHA    ALPHA     9.2000E+00  2.3920E+00
316097  ALPHA    ALPHA     8.0000E+00  2.2400E+00
316097  ALPHA    ALPHA     8.4000E+00  2.3520E+00
317104  ALPHA    ALPHA     2.0000E+00  1.5000E+00
319098  ALPHA    ALPHA     8.5000E+00  2.2950E+00
320096  ALPHA    ALPHA     5.9000E+00  2.2420E+00
323099  ALPHA    ALPHA     2.3000E+00  1.5870E+00
324100  ALPHA    ALPHA     9.2000E+00  2.3000E+00
326102  ALPHA    ALPHA     3.8000E+00  1.5960E+00
328101  ALPHA    ALPHA     7.2000E+00  2.3040E+00

        AREA 3   GROSS BETA

303116  BETA     BETA      4.0400E+01  2.0200E+00
305113  BETA     BETA      3.7600E+01  1.8800E+00
305113  BETA     BETA      3.9800E+01  1.9900E+00
306115  BETA     BETA      2.9900E+01  1.7940E+00
309114  BETA     BETA      3.8100E+01  1.9050E+00
312105  BETA     BETA      3.3900E+01  2.0340E+00
316097  BETA     BETA      4.8900E+01  2.4450E+00
316097  BETA     BETA      5.0400E+01  2.5200E+00
317104  BETA     BETA      2.5300E+01  1.7710E+00
319098  BETA     BETA      2.9000E+01  1.7400E+00
320096  BETA     BETA      3.9900E+01  1.9950E+00
323099  BETA     BETA      4.2800E+01  2.1400E+00
324100  BETA     BETA      4.1700E+01  2.0850E+00
326102  BETA     BETA      4.3300E+01  2.1650E+00
328101  BETA     BETA      3.4900E+01  1.7450E+00

        AREA 4   MAN-MADE NUCLIDES

421030  GAMMA    CO-60     1.9360E-02  1.4714E-02
401012  GAMMA    CS-137    9.0000E-02  2.4300E-02
402014  GAMMA    CS-137    7.0000E-02  2.4500E-02
403015  GAMMA    CS-137    9.0000E-02  2.4300E-02
404011  GAMMA    CS-137    1.0000E-01  2.6000E-02
405013  GAMMA    CS-137    8.0000E-02  5.6800E-02
406016  GAMMA    CS-137    1.1000E-01  3.4100E-02
407001  GAMMA    CS-137    1.1080E-01  6.4264E-02
408019  GAMMA    CS-137    1.2000E-01  3.3600E-02
409022  GAMMA    CS-137    7.2850E-02  2.5497E-02
410021  GAMMA    CS-137    9.3000E-02  2.6970E-02
411020  GAMMA    CS-137    1.3000E-01  3.5100E-02
412018  GAMMA    CS-137    6.0000E-02  2.2800E-02
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413017	GAMMA	CS-137	1.1000E-01	3.0800E-02
413017	GAMMA	CS-137	8.0000E-02	2.7200E-02
414002	GAMMA	CS-137	9.0000E-02	3.3300E-02
415026	GAMMA	CS-137	9.9960E-02	2.5990E-02
416028	GAMMA	CS-137	1.2700E-01	2.4130E-02
417023	GAMMA	CS-137	1.0200E-01	2.4480E-02
418025	GAMMA	CS-137	9.4000E-02	2.5380E-02
419027	GAMMA	CS-137	7.7140E-02	3.0856E-02
420029	GAMMA	CS-137	7.8000E-02	2.1840E-02
421030	GAMMA	CS-137	3.1460E-02	2.1393E-02
422024	GAMMA	CS-137	9.3000E-02	3.8130E-02
423032	GAMMA	CS-137	5.9000E-02	3.0680E-02
423032	GAMMA	CS-137	7.0000E-02	2.8000E-02
424034	GAMMA	CS-137	9.8000E-02	2.3520E-02
425033	GAMMA	CS-137	9.6000E-02	2.2080E-02
426031	GAMMA	CS-137	1.1180E-01	3.5776E-02
401012	PU	PU-238	1.1540E-02	1.5260E-02
402014	PU	PU-238	9.5210E-03	1.1350E-02
403015	PU	PU-238	1.8280E-02	1.5170E-02
404011	PU	PU-238	1.3990E-02	1.5350E-02
405013	PU	PU-238	2.4800E-02	1.9330E-02
406016	PU	PU-238	1.3750E-02	1.7350E-02
407001	PU	PU-238	9.8363E-03	1.3642E-02
408019	PU	PU-238	7.8250E-03	1.3980E-02
409022	PU	PU-238	1.6337E-02	1.7092E-02
410021	PU	PU-238	5.3680E-03	1.1090E-02
411020	PU	PU-238	1.3380E-02	1.2880E-02
412018	PU	PU-238	-7.8000E-03	1.2091E-02
413017	PU	PU-238	1.6240E-02	1.7810E-02
413017	PU	PU-238	2.1170E-01	4.7080E-02
414002	PU	PU-238	5.0880E-03	1.7090E-02
415026	PU	PU-238	6.3094E-03	1.5653E-02
416028	PU	PU-238	6.1500E-03	1.0050E-02
417023	PU	PU-238	1.1830E-02	1.8790E-02
418025	PU	PU-238	4.6320E-03	1.3350E-02
419027	PU	PU-238	2.6001E-02	1.4228E-02
420029	PU	PU-238	-2.3660E-03	1.4320E-02
421030	PU	PU-238	1.7151E-02	1.3741E-02
422024	PU	PU-238	1.8470E-02	2.0330E-02
423032	PU	PU-238	1.7840E-02	1.8310E-02
423032	PU	PU-238	-4.0460E-03	1.9690E-02
424034	PU	PU-238	9.7660E-03	2.1220E-02
425033	PU	PU-238	1.4050E-02	1.3070E-02
426031	PU	PU-238	9.4718E-03	7.7090E-03
401012	PU	PU-239	4.0920E-02	1.8210E-02
402014	PU	PU-239	2.2180E-02	1.3140E-02
403015	PU	PU-239	4.1770E-02	1.8440E-02
404011	PU	PU-239	4.5060E-02	2.0120E-02
405013	PU	PU-239	5.1980E-02	2.2070E-02
406016	PU	PU-239	8.6160E-03	8.3320E-03
407001	PU	PU-239	3.6481E-02	1.7094E-02
408019	PU	PU-239	2.3710E-02	1.6240E-02
409022	PU	PU-239	4.4509E-02	1.7580E-02
410021	PU	PU-239	2.6270E-02	1.6110E-02
411020	PU	PU-239	5.8760E-02	2.7800E-02

412018	PU	PU-239	7.3000E-03	8.7994E-03
413017	PU	PU-239	1.2070E-02	1.0170E-02
413017	PU	PU-239	8.1600E-02	2.6680E-02
414002	PU	PU-239	2.9860E-02	1.6840E-02
415026	PU	PU-239	7.9944E-02	2.9084E-02
416028	PU	PU-239	4.4350E-02	2.0970E-02
417023	PU	PU-239	2.1980E-02	1.2890E-02
418025	PU	PU-239	4.7420E-02	1.9640E-02
419027	PU	PU-239	3.4474E-02	1.5617E-02
420029	PU	PU-239	3.4260E-02	2.0880E-02
421030	PU	PU-239	2.0926E-02	1.3905E-02
422024	PU	PU-239	7.5950E-02	2.8500E-02
423032	PU	PU-239	2.0790E-02	2.0250E-02
423032	PU	PU-239	3.1700E-02	2.0740E-02
424034	PU	PU-239	7.1630E-02	2.9110E-02
425033	PU	PU-239	4.8720E-02	2.2690E-02
426031	PU	PU-239	2.5129E-02	1.1489E-02
401012	SR	SR-90	-1.1900E-01	1.0100E-01
402014	SR	SR-90	-1.8400E-01	1.1900E-01
403015	SR	SR-90	-5.5000E-02	2.1100E-01
404011	SR	SR-90	3.7000E-02	1.7000E-01
405013	SR	SR-90	-1.8000E-02	1.1000E-01
406016	SR	SR-90	0.0000E-01	9.2000E-02
409022	SR	SR-90	9.4000E-03	1.8800E-01
410021	SR	SR-90	-9.3000E-02	1.9000E-02
411020	SR	SR-90	-5.5000E-02	6.4000E-02
414002	SR	SR-90	-7.0000E-02	2.4000E-01
415026	SR	SR-90	9.5200E-02	2.5990E-01
416028	SR	SR-90	-5.6000E-02	7.4000E-02
417023	SR	SR-90	1.8000E-02	4.6000E-02
418025	SR	SR-90	9.0000E-03	4.7000E-02
420029	SR	SR-90	-5.6000E-02	5.6000E-02
421030	SR	SR-90	0.0000E-01	3.1460E-01
422024	SR	SR-90	0.0000E-01	5.0000E-02
423032	SR	SR-90	8.4000E-02	3.7000E-02
423032	SR	SR-90	-4.7000E-02	4.7000E-02
424034	SR	SR-90	-7.5000E-02	5.6000E-02
425033	SR	SR-90	4.7000E-02	5.6000E-02

AREA 4 NATURAL NUCLIDES

407001	GAMMA	BE-7	4.4320E-01	2.3490E-01
401012	GAMMA	BI-214	7.3000E-01	5.8400E-02
402014	GAMMA	BI-214	7.3000E-01	6.5700E-02
403015	GAMMA	BI-214	8.5000E-01	5.9500E-02
404011	GAMMA	BI-214	7.0000E-01	6.3000E-02
405013	GAMMA	BI-214	7.0000E-01	9.1000E-02
406016	GAMMA	BI-214	6.2000E-01	9.8400E-02
407001	GAMMA	BI-214	8.5870E-01	1.1163E-01
408019	GAMMA	BI-214	7.0000E-01	8.4000E-02
409022	GAMMA	BI-214	6.1100E-01	6.7210E-02
410021	GAMMA	BI-214	8.2000E-01	7.3800E-02
411020	GAMMA	BI-214	7.3000E-01	9.4900E-02
412018	GAMMA	BI-214	8.7000E-01	6.0900E-02
413017	GAMMA	BI-214	7.6000E-01	6.8400E-02

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413017   GAMMA     BI-214    7,6000E-01  6,8400E-02
414002   GAMMA     BI-214    7,3000E-01  9,4900E-02
415026   GAMMA     BI-214    5,4740E-01  6,0214E-02
416028   GAMMA     BI-214    7,9200E-01  1,5048E-01
417023   GAMMA     BI-214    8,1000E-01  6,4800E-02
418025   GAMMA     BI-214    6,7100E-01  6,0390E-02
419027   GAMMA     BI-214    7,9800E-01  1,0374E-01
420029   GAMMA     BI-214    7,3000E-01  5,8400E-02
421030   GAMMA     BI-214    6,0500E-01  6,6550E-02
422024   GAMMA     BI-214    7,6700E-01  9,2040E-02
423032   GAMMA     BI-214    8,1800E-01  8,9980E-02
423032   GAMMA     BI-214    8,4000E-01  9,2400E-02
424034   GAMMA     BI-214    7,6600E-01  6,1280E-02
425033   GAMMA     BI-214    6,7100E-01  5,3680E-02
426031   GAMMA     BI-214    8,8400E-01  1,0608E-01
401012   GAMMA     K-40      1,8700E+01  5,6100E-01
402014   GAMMA     K-40      2,1100E+01  8,4400E-01
403015   GAMMA     K-40      2,0600E+01  6,1800E-01
404011   GAMMA     K-40      2,1600E+01  8,6400E-01
405013   GAMMA     K-40      2,0200E+01  1,2120E+00
406016   GAMMA     K-40      2,1100E+01  1,2660E+00
407001   GAMMA     K-40      2,2991E+01  1,3795E+00
407001   GAMMA     K-40      9,1410E-01  6,0331E-01
408019   GAMMA     K-40      1,9500E+01  9,7500E-01
409022   GAMMA     K-40      2,2325E+01  6,6975E-01
410021   GAMMA     K-40      2,4400E+01  9,7600E-01
411020   GAMMA     K-40      1,9800E+01  1,1880E+00
412018   GAMMA     K-40      2,1100E+01  6,3300E-01
413017   GAMMA     K-40      2,1600E+01  8,6400E-01
413017   GAMMA     K-40      2,2200E+01  8,8800E-01
414002   GAMMA     K-40      2,2000E+01  1,1000E+00
415026   GAMMA     K-40      2,0230E+01  6,0690E-01
416028   GAMMA     K-40      2,0800E+01  6,2400E-01
417023   GAMMA     K-40      2,1400E+01  6,4200E-01
418025   GAMMA     K-40      1,9900E+01  7,9600E-01
419027   GAMMA     K-40      2,1280E+01  1,2768E+00
420029   GAMMA     K-40      2,0200E+01  6,0600E-01
421030   GAMMA     K-40      2,2506E+01  6,7518E-01
422024   GAMMA     K-40      1,9800E+01  1,1880E+00
423032   GAMMA     K-40      1,9300E+01  1,1580E+00
423032   GAMMA     K-40      2,0000E+01  1,2000E+00
424034   GAMMA     K-40      1,9700E+01  5,9100E-01
425033   GAMMA     K-40      1,8200E+01  7,2800E-01
426031   GAMMA     K-40      2,1580E+01  1,2948E+00
401012   PB        PB-210    3,5781E+00  1,6802E+00
402014   PB        PB-210    2,3214E+00  9,1184E-01
403015   PB        PB-210    4,8089E+00  1,5312E+00
404011   PB        PB-210    2,2755E+00  7,4224E-01
405013   PB        PB-210    1,3495E+00  5,8039E-01
406016   PB        PB-210    4,5156E+00  1,3043E+00
408019   PB        PB-210    2,8788E+00  7,9854E-01
409022   PB        PB-210    3,6252E+00  1,2892E+00
411020   PB        PB-210    3,8930E+00  9,5978E-01
412018   PB        PB-210    2,2703E+00  9,3580E-01
413017   PB        PB-210    2,9360E+00  8,0709E-01
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413017  PB        PB-210    3.7051E+00  1.6287E+00
414002  PB        PB-210    3.4449E+00  1.3541E+00
415026  PB        PB-210    2.8629E+00  8.9569E-01
421030  PB        PB-210    1.0252E+00  5.5754E-01
401012  GAMMA     PB-214    7.6000E-01  5.3200E-02
402014  GAMMA     PB-214    7.7000E-01  6.9300E-02
403015  GAMMA     PB-214    8.7000E-01  6.0900E-02
404011  GAMMA     PB-214    7.4000E-01  6.6600E-02
405013  GAMMA     PB-214    8.2000E-01  8.2000E-02
406016  GAMMA     PB-214    8.9000E-01  8.9000E-02
407001  GAMMA     PB-214    7.4790E-02  6.2824E-02
407001  GAMMA     PB-214    9.4180E-01  1.2243E-01
408019  GAMMA     PB-214    7.9000E-01  8.6900E-02
409022  GAMMA     PB-214    7.2850E-01  6.5565E-02
410021  GAMMA     PB-214    8.0000E-01  8.0000E-02
411020  GAMMA     PB-214    7.8000E-01  8.5800E-02
412018  GAMMA     PB-214    8.7000E-01  6.0900E-02
413017  GAMMA     PB-214    8.2000E-01  8.2000E-02
413017  GAMMA     PB-214    8.4000E-01  6.7200E-02
414002  GAMMA     PB-214    8.4000E-01  8.4000E-02
415026  GAMMA     PB-214    7.1400E-01  6.4260E-02
416028  GAMMA     PB-214    7.2900E-01  5.1030E-02
417023  GAMMA     PB-214    8.8000E-01  6.1600E-02
418025  GAMMA     PB-214    7.1600E-01  7.1600E-02
419027  GAMMA     PB-214    8.7780E-01  7.9002E-02
420029  GAMMA     PB-214    7.8000E-01  5.4600E-02
421030  GAMMA     PB-214    7.7440E-01  6.1952E-02
422024  GAMMA     PB-214    8.3700E-01  8.3700E-02
423032  GAMMA     PB-214    8.6400E-01  1.0368E-01
423032  GAMMA     PB-214    8.6400E-01  9.5040E-02
424034  GAMMA     PB-214    8.3200E-01  5.8240E-02
425033  GAMMA     PB-214    7.7600E-01  6.2080E-02
426031  GAMMA     PB-214    9.3600E-01  8.4240E-02
401012  PO        PO-210    2.9539E+00  5.2950E-01
402014  PO        PO-210    2.1580E+00  3.6934E-01
403015  PO        PO-210    2.5932E+00  4.4818E-01
404011  PO        PO-210    3.0231E+00  5.2245E-01
405013  PO        PO-210    2.4107E+00  4.5747E-01
406016  PO        PO-210    2.8505E+00  4.5384E-01
408019  PO        PO-210    2.9132E+00  5.2417E-01
409022  PO        PO-210    2.9337E+00  4.9584E-01
411020  PO        PO-210    2.5454E+00  3.8820E-01
412018  PO        PO-210    1.8760E+00  3.2578E-01
413017  PO        PO-210    2.0370E+00  3.5588E-01
413017  PO        PO-210    2.8998E+00  5.1163E-01
414002  PO        PO-210    2.5900E+00  4.4049E-01
415026  PO        PO-210    3.1936E+00  4.8608E-01
421030  PO        PO-210    2.3720E+00  4.0484E-01
401012  RA        RA-226    7.7000E-01  3.8500E-02
402014  RA        RA-226    9.6000E-01  4.8000E-02
403015  RA        RA-226    1.1000E+00  4.4000E-02
404011  RA        RA-226    1.2100E+00  4.8400E-02
405013  RA        RA-226    8.2000E-01  1.8000E-02
406016  RA        RA-226    9.3000E-01  4.6500E-02
407001  RA        RA-226    8.8640E-01  4.4320E-02
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408019  RA        RA-226   8.6000E-01  4.3000E-02
409022  RA        RA-226   9.4000E-01  4.7000E-02
410021  RA        RA-226   1.1000E+00  4.4000E-02
411020  RA        RA-226   8.4000E-01  4.2000E-02
412018  RA        RA-226   9.4000E-01  4.7000E-02
413017  RA        RA-226   1.0300E+00  4.1200E-02
413017  RA        RA-226   1.0800E+00  4.3200E-02
414002  RA        RA-226   7.9000E-01  4.7400E-02
415026  RA        RA-226   1.1900E+00  4.7600E-02
416028  RA        RA-226   1.0700E+00  5.3500E-02
417023  RA        RA-226   1.0800E+00  4.3200E-02
418025  RA        RA-226   1.0700E+00  5.3500E-02
419027  RA        RA-226   9.0440E-01  4.5220E-02
420029  RA        RA-226   8.6000E-01  4.3000E-02
421030  RA        RA-226   9.6800E-01  3.8720E-02
422024  RA        RA-226   1.1200E+00  4.4800E-02
423032  RA        RA-226   8.5000E-01  4.2500E-02
423032  RA        RA-226   8.7000E-01  4.3500E-02
424034  RA        RA-226   1.2200E+00  4.8800E-02
425033  RA        RA-226   8.5000E-01  4.2500E-02
426031  RA        RA-226   9.1000E-01  4.5500E-02
401012  TH        TH-227   7.3450E-02  3.7340E-02
402014  TH        TH-227   1.1720E-01  4.6340E-02
403015  TH        TH-227   1.0390E-01  4.0310E-02
404011  TH        TH-227   9.7080E-02  4.1620E-02
405013  TH        TH-227   7.0200E-02  3.5750E-02
406016  TH        TH-227   1.0350E-01  4.1100E-02
407001  TH        TH-227   2.6484E-01  6.2907E-02
408019  TH        TH-227   1.0090E-01  3.6950E-02
409022  TH        TH-227   2.3711E-01  6.4719E-02
410021  TH        TH-227   1.4260E-01  4.6530E-02
411020  TH        TH-227   1.3360E-01  4.3560E-02
413017  TH        TH-227   1.4110E-01  4.3240E-02
413017  TH        TH-227   6.5110E-02  3.1960E-02
414002  TH        TH-227   4.2270E-02  3.0150E-02
415026  TH        TH-227   2.5014E-01  5.9524E-02
416028  TH        TH-227   1.2950E-01  4.5450E-02
417023  TH        TH-227   1.5770E-01  5.2810E-02
418025  TH        TH-227   1.4890E-01  4.9180E-02
419027  TH        TH-227   2.5714E-01  6.6394E-02
420029  TH        TH-227   1.6960E-01  4.7660E-02
421030  TH        TH-227   3.4219E-01  7.8287E-02
422024  TH        TH-227   1.0450E-01  5.2200E-02
423032  TH        TH-227   1.5560E-01  5.2460E-02
423032  TH        TH-227   1.8430E-01  5.2810E-02
425033  TH        TH-227   1.6130E-01  5.5990E-02
426031  TH        TH-227   2.7352E-01  6.4532E-02
401012  TH        TH-228   8.9210E-01  1.3410E-01
402014  TH        TH-228   1.1660E+00  1.7010E-01
403015  TH        TH-228   9.4750E-01  1.3700E-01
404011  TH        TH-228   1.0310E+00  1.5110E-01
405013  TH        TH-228   1.0130E+00  1.4610E-01
406016  TH        TH-228   8.6410E-01  8.7400E-02
407001  TH        TH-228   1.0454E+00  9.6839E-02
408019  TH        TH-228   9.6110E-01  8.9940E-02
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409022  TH        TH-228   1.0004E+00  9.9029E-02
410021  TH        TH-228   1.1190E+00  1.0750E-01
411020  TH        TH-228   9.5720E-01  9.5380E-02
413017  TH        TH-228   8.2160E-01  8.2080E-02
413017  TH        TH-228   9.0920E-01  8.6640E-02
414002  TH        TH-228   1.1560E+00  1.6350E-01
415026  TH        TH-228   9.2058E-01  8.9226E-02
416028  TH        TH-228   1.0790E+00  1.0260E-01
417023  TH        TH-228   1.1490E+00  1.1450E-01
418025  TH        TH-228   1.0740E+00  1.0710E-01
419027  TH        TH-228   1.1340E+00  1.0300E-01
420029  TH        TH-228   1.0330E+00  9.1580E-02
421030  TH        TH-228   1.1977E+00  1.1318E-01
422024  TH        TH-228   1.1010E+00  1.2000E-01
423032  TH        TH-228   1.0150E+00  9.3730E-02
423032  TH        TH-228   9.7290E-01  9.7220E-02
425033  TH        TH-228   1.1510E+00  1.0980E-01
426031  TH        TH-228   9.5056E-01  9.2404E-02
401012  TH        TH-230   1.1670E+00  1.6250E-01
402014  TH        TH-230   1.1810E+00  1.6930E-01
403015  TH        TH-230   1.1520E+00  1.5700E-01
404011  TH        TH-230   1.2580E+00  1.7480E-01
405013  TH        TH-230   1.2340E+00  1.6770E-01
406016  TH        TH-230   1.0430E+00  9.0290E-02
407001  TH        TH-230   1.1767E+00  9.7199E-02
408019  TH        TH-230   1.1250E+00  9.1560E-02
409022  TH        TH-230   1.2979E+00  1.0911E-01
410021  TH        TH-230   1.2090E+00  1.0250E-01
411020  TH        TH-230   1.2090E+00  9.8510E-02
413017  TH        TH-230   1.0800E+00  8.8460E-02
413017  TH        TH-230   1.1530E+00  9.1800E-02
414002  TH        TH-230   1.3720E+00  1.8480E-01
415026  TH        TH-230   7.7897E-02  2.2631E-02
416028  TH        TH-230   1.3380E+00  1.0580E-01
417023  TH        TH-230   1.2750E+00  1.1140E-01
418025  TH        TH-230   1.2610E+00  1.0650E-01
419027  TH        TH-230   1.2526E+00  1.0300E-01
420029  TH        TH-230   1.1940E+00  9.2830E-02
421030  TH        TH-230   1.4365E+00  1.1989E-01
422024  TH        TH-230   1.2410E+00  1.1560E-01
423032  TH        TH-230   1.1820E+00  9.9710E-02
423032  TH        TH-230   1.2140E+00  9.6410E-02
425033  TH        TH-230   1.2010E+00  1.0490E-01
426031  TH        TH-230   1.2496E+00  1.0109E-01
401012  GAMMA     TH-232   7.3000E-01  8.0300E-02
402014  GAMMA     TH-232   9.6000E-01  1.0560E-01
403015  GAMMA     TH-232   8.7000E-01  9.5700E-02
404011  GAMMA     TH-232   8.4000E-01  1.0080E-01
405013  GAMMA     TH-232   7.7000E-01  1.4630E-01
406016  GAMMA     TH-232   8.4000E-01  1.5120E-01
407001  GAMMA     TH-232   9.9720E-01  1.7950E-01
408019  GAMMA     TH-232   8.8000E-01  1.4960E-01
409022  GAMMA     TH-232   8.9300E-01  8.9300E-02
410021  GAMMA     TH-232   9.6000E-01  1.1520E-01
411020  GAMMA     TH-232   8.5000E-01  1.5300E-01
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412018	GAMMA	TH-232	9.8000E-01	9.8000E-02
413017	GAMMA	TH-232	9.1000E-01	1.0010E-01
413017	GAMMA	TH-232	9.6000E-01	1.0560E-01
414002	GAMMA	TH-232	1.0200E+00	1.6320E-01
415026	GAMMA	TH-232	8.3300E-01	9.1630E-02
416028	GAMMA	TH-232	8.9600E-01	8.9600E-02
417023	GAMMA	TH-232	8.6000E-01	9.4600E-02
418025	GAMMA	TH-232	7.8300E-01	9.3960E-02
419027	GAMMA	TH-232	9.3100E-01	1.6758E-01
420029	GAMMA	TH-232	9.1000E-01	9.1000E-02
421030	GAMMA	TH-232	9.1960E-01	9.1960E-02
422024	GAMMA	TH-232	8.1400E-01	1.4652E-01
423032	GAMMA	TH-232	7.9500E-01	1.5105E-01
423032	GAMMA	TH-232	8.6400E-01	1.5552E-01
424034	GAMMA	TH-232	8.7500E-01	8.7500E-02
425033	GAMMA	TH-232	8.3900E-01	9.2290E-02
426031	GAMMA	TH-232	9.3600E-01	1.6848E-01
401012	TH	TH-232	1.4140E+00	1.9140E-01
402014	TH	TH-232	1.5240E+00	2.1050E-01
403015	TH	TH-232	1.3090E+00	1.7480E-01
404011	TH	TH-232	1.3570E+00	1.8590E-01
405013	TH	TH-232	1.2410E+00	1.6860E-01
406016	TH	TH-232	1.1370E+00	9.4370E-02
407001	TH	TH-232	1.3210E+00	1.0354E-01
408019	TH	TH-232	1.1300E+00	9.1790E-02
409022	TH	TH-232	1.3379E+00	1.1036E-01
410021	TH	TH-232	1.4370E+00	1.1370E-01
411020	TH	TH-232	1.3600E+00	1.0510E-01
413017	TH	TH-232	1.1020E+00	8.9460E-02
413017	TH	TH-232	1.1970E+00	9.3780E-02
414002	TH	TH-232	1.4060E+00	1.8840E-01
415026	TH	TH-232	0.0000E-01	0.0000E-01
416028	TH	TH-232	1.3740E+00	1.0680E-01
417023	TH	TH-232	1.3170E+00	1.1310E-01
418025	TH	TH-232	1.4080E+00	1.1330E-01
419027	TH	TH-232	1.3287E+00	1.0624E-01
420029	TH	TH-232	1.3870E+00	9.9640E-02
421030	TH	TH-232	1.4786E+00	1.2144E-01
422024	TH	TH-232	1.4990E+00	1.2890E-01
423032	TH	TH-232	1.1950E+00	1.0030E-01
423032	TH	TH-232	1.3580E+00	1.0230E-01
425033	TH	TH-232	1.3710E+00	1.1270E-01
426031	TH	TH-232	1.3177E+00	1.0408E-01
401012	U	U-234	1.0460E+00	1.5160E-01
402014	U	U-234	1.0460E+00	1.4730E-01
403015	U	U-234	5.5130E-01	1.0310E-01
404011	U	U-234	1.1470E+00	1.8040E-01
406016	U	U-234	6.9840E-01	1.2580E-01
407001	U	U-234	9.5565E-01	1.2435E-01
408019	U	U-234	1.0120E+00	1.4290E-01
409022	U	U-234	8.2837E-01	1.1538E-01
410021	U	U-234	8.5230E-01	1.3820E-01
411020	U	U-234	9.9520E-01	1.6630E-01
413017	U	U-234	1.0190E+00	1.5220E-01
413017	U	U-234	1.0580E+00	1.5490E-01

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414002  U        U-234    1.0390E+00  1.5480E-01
415026  U        U-234    1.0869E+00  1.5180E-01
416028  U        U-234    1.2410E+00  1.6200E-01
417023  U        U-234    1.0730E+00  1.4030E-01
418025  U        U-234    1.0910E+00  1.3820E-01
419027  U        U-234    1.1776E+00  1.4311E-01
420029  U        U-234    1.2260E+00  1.6120E-01
421030  U        U-234    8.0102E-01  1.2144E-01
422024  U        U-234    1.0340E+00  1.4320E-01
423032  U        U-234    1.1720E+00  1.5400E-01
424034  U        U-234    1.1400E+00  1.4830E-01
425033  U        U-234    7.9150E-01  1.0920E-01
426031  U        U-234    1.1081E+00  1.3692E-01
401012  U        U-235    6.2300E-02  2.6220E-02
402014  U        U-235    2.9510E-02  1.7050E-02
403015  U        U-235    2.1710E-02  1.8740E-02
404011  U        U-235    1.1740E-01  4.2900E-02
406016  U        U-235    2.9470E-02  1.9920E-02
407001  U        U-235    3.6232E-02  1.6897E-02
408019  U        U-235    1.7810E-02  1.5960E-02
409022  U        U-235    4.0631E-02  1.7475E-02
410021  U        U-235    4.5650E-02  2.2550E-02
411020  U        U-235    6.1220E-02  2.9030E-02
413017  U        U-235    3.7090E-02  2.1760E-02
413017  U        U-235    4.8320E-02  2.3000E-02
414002  U        U-235    3.4640E-02  1.9740E-02
415026  U        U-235    2.7798E-02  1.5625E-02
416028  U        U-235    3.5170E-02  1.8610E-02
417023  U        U-235    7.5540E-02  2.5060E-02
418025  U        U-235    2.0010E-02  1.2040E-02
419027  U        U-235    4.1443E-02  1.7729E-02
420029  U        U-235    2.8070E-02  1.6090E-02
421030  U        U-235    2.7854E-02  1.5314E-02
422024  U        U-235    3.6830E-02  1.8240E-02
423032  U        U-235    3.6920E-02  1.8230E-02
424034  U        U-235    3.5970E-02  1.7670E-02
425033  U        U-235    7.2980E-02  2.4480E-02
426031  U        U-235    5.5354E-02  2.1385E-02
404011  GAMMA    U-238    2.7900E+00  2.8458E+00
409022  GAMMA    U-238    2.8200E+00  2.8482E+00
421030  GAMMA    U-238    2.2022E+00  1.4755E+00
423032  GAMMA    U-238    5.2270E+00  5.0702E+00
401012  U        U-238    9.3280E-01  1.3890E-01
402014  U        U-238    7.5490E-01  1.1540E-01
403015  U        U-238    7.5120E-01  1.2760E-01
404011  U        U-238    1.0570E+00  1.6920E-01
406016  U        U-238    9.8270E-01  1.6050E-01
407001  U        U-238    9.7033E-01  1.2543E-01
408019  U        U-238    9.6880E-01  1.3800E-01
409022  U        U-238    9.2684E-01  1.2629E-01
410021  U        U-238    9.8160E-01  1.5420E-01
411020  U        U-238    1.0080E+00  1.6720E-01
413017  U        U-238    9.5220E-01  1.4470E-01
413017  U        U-238    9.7690E-01  1.4570E-01
414002  U        U-238    8.1730E-01  1.2890E-01
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415026  U        U-238     9.6200E-01  1.3733E-01
416028  U        U-238     1.1370E+00  1.5130E-01
417023  U        U-238     9.6880E-01  1.2960E-01
418025  U        U-238     1.1120E+00  1.4040E-01
419027  U        U-238     9.8367E-01  1.2436E-01
420029  U        U-238     1.3050E+00  1.6920E-01
421030  U        U-238     9.5663E-01  1.3978E-01
422024  U        U-238     1.0710E+00  1.4710E-01
423032  U        U-238     1.1150E+00  1.4810E-01
424034  U        U-238     1.0960E+00  1.4380E-01
425033  U        U-238     9.3820E-01  1.2420E-01
426031  U        U-238     1.0897E+00  1.3515E-01

        AREA 4   GROSS ALPHA

401012  ALPHA    ALPHA     2.5000E+00  1.4000E+00
402014  ALPHA    ALPHA     1.4000E+00  1.4000E+00
403015  ALPHA    ALPHA     1.8000E+00  1.2960E+00
404011  ALPHA    ALPHA     3.6000E+00  1.9440E+00
405013  ALPHA    ALPHA     7.9000E+00  2.2120E+00
406016  ALPHA    ALPHA     3.0000E+00  1.4700E+00
407001  ALPHA    ALPHA     1.2700E+01  2.7940E+00
408019  ALPHA    ALPHA     2.4000E+00  1.8240E+00
409022  ALPHA    ALPHA     5.5000E+00  1.8700E+00
410021  ALPHA    ALPHA     1.1000E+00  1.4080E+00
411020  ALPHA    ALPHA     8.8000E+00  2.3760E+00
412018  ALPHA    ALPHA     3.4000E+00  1.7680E+00
413017  ALPHA    ALPHA     1.9000E+00  1.5010E+00
413017  ALPHA    ALPHA     2.3000E+00  1.3800E+00
414002  ALPHA    ALPHA     6.5000E+00  2.1450E+00
415026  ALPHA    ALPHA     5.9000E+00  2.0650E+00
416028  ALPHA    ALPHA     8.0000E-01  1.2720E+00
417023  ALPHA    ALPHA     5.6000E+00  2.0160E+00
418025  ALPHA    ALPHA     1.0600E+01  2.5440E+00
419027  ALPHA    ALPHA     1.1300E+01  2.5990E+00
420029  ALPHA    ALPHA     1.9000E+00  1.2540E+00
421030  ALPHA    ALPHA     7.3000E+00  2.2630E+00
422024  ALPHA    ALPHA     4.3000E+00  1.8490E+00
423032  ALPHA    ALPHA     5.0000E+00  2.1500E+00
423032  ALPHA    ALPHA     5.2000E+00  1.9760E+00
424034  ALPHA    ALPHA     2.4000E+00  1.5120E+00
425033  ALPHA    ALPHA     1.0800E+01  2.4840E+00
426031  ALPHA    ALPHA     1.0400E+01  2.3920E+00

        AREA 4   GROSS BETA

401012  BETA     BETA      3.3700E+01  2.0220E+00
402014  BETA     BETA      4.3500E+01  2.1750E+00
403015  BETA     BETA      3.5700E+01  1.7850E+00
404011  BETA     BETA      4.0000E+01  2.0000E+00
405013  BETA     BETA      4.1800E+01  2.0900E+00
406016  BETA     BETA      3.5100E+01  1.7550E+00
407001  BETA     BETA      3.9200E+01  1.9600E+00
408019  BETA     BETA      3.5400E+01  1.7700E+00
409022  BETA     BETA      5.4300E+01  2.1720E+00
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410021  BETA      BETA      4.3800E+01  2.1900E+00
411020  BETA      BETA      4.4400E+01  2.2200E+00
412018  BETA      BETA      4.2700E+01  2.1350E+00
413017  BETA      BETA      4.2900E+01  2.1450E+00
413017  BETA      BETA      4.3200E+01  2.1600E+00
414002  BETA      BETA      3.1800E+01  1.9080E+00
415026  BETA      BETA      4.0800E+01  2.0400E+00
416028  BETA      BETA      4.4400E+01  2.2200E+00
417023  BETA      BETA      4.2800E+01  2.1400E+00
418025  BETA      BETA      4.1000E+01  2.0500E+00
419027  BETA      BETA      4.4000E+01  2.2000E+00
420029  BETA      BETA      4.0900E+01  2.0450E+00
421030  BETA      BETA      4.2500E+01  2.1250E+00
422024  BETA      BETA      4.0300E+01  2.0150E+00
423032  BETA      BETA      3.2000E+01  1.9200E+00
423032  BETA      BETA      4.0400E+01  2.0200E+00
424034  BETA      BETA      4.0900E+01  2.0450E+00
425033  BETA      BETA      3.8100E+01  1.9050E+00
426031  BETA      BETA      3.1900E+01  1.9140E+00

        AREA 5    MAN-MADE NUCLIDES

505148  GAMMA     CS-137    3.1000E-02  1.3950E-02
504147  PU        PU-238    1.6912E-02  1.6867E-02
504147  PU        PU-239    8.3574E-03  1.3620E-02
504147  SR        SR-90     0.0000E-01  4.3210E-01

        AREA 5    NATURAL NUCLIDES

504147  GAMMA     BI-214    5.8110E-01  3.4866E-02
505148  GAMMA     BI-214    6.5800E-01  3.9480E-02
504147  GAMMA     K-40      1.6390E+01  3.2780E-01
505148  GAMMA     K-40      1.6400E+01  4.9200E-01
504147  PB        PB-210    1.2030E+00  7.5730E-01
504147  GAMMA     PB-214    6.1090E-01  3.6654E-02
505148  GAMMA     PB-214    6.7300E-01  4.7110E-02
504147  PO        PO-210    1.1430E+00  2.1080E-01
504147  RA        RA-226    7.4500E-01  4.4700E-02
504147  TH        TH-227    9.0011E-02  4.2748E-02
504147  TH        TH-228    7.6288E-01  8.5824E-02
504147  TH        TH-230    7.1550E-01  7.5513E-02
504147  GAMMA     TH-232    6.8540E-01  5.4832E-02
505148  GAMMA     TH-232    6.7300E-01  6.0570E-02
504147  TH        TH-232    8.9519E-01  8.6003E-02
504147  U         U-234     4.8693E-01  8.4826E-02
504147  U         U-235     2.5688E-02  1.5287E-02
505148  GAMMA     U-238     1.9430E+00  1.9236E+00
504147  U         U-238     7.0954E-01  1.1165E-01

        AREA 5    GROSS ALPHA

504147  ALPHA     ALPHA     7.2000E+00  2.0880E+00
505148  ALPHA     ALPHA     4.7000E+00  1.7390E+00
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            AREA 5    GROSS BETA

     504147  BETA      BETA        2.7500E+01  1.6500E+00
     505148  BETA      BETA        3.3000E+01  1.9800E+00
```

APPENDIX E

STATISTICAL SUMMARIES OF EERF RADIONUCLIDE ANALYSES

CONTENTS

1981 NOAA Samples E-1 to E-3

1981/1982 FDA Marketplace Seafood Samples E-4

1982 EPA Radiological Monitoring Survey

- A. Edible Biota Samples E-5 to E-8
- B. Nonedible Biota Samples E-9 to E-12
- C. Sediment Samples E-13 to E-17

NOTE: For Gamma Analyses

Number (1) = Total Samples Analyzed

Number (2) = Number of Samples where gamma activity was detected by the analysis program (MONSTR)

Radionuclide Analyses of Edible Biota Samples
1981 NOAA Sampling for EPA

pCi/g wet

NUCLIDE	ANALYSIS	MEAN	STD DEV	MINIMUM	MAXIMUM	MEDIAN	NUMBER
CS-137	GAMMA	1.98E-02	4.66E-03	1.40E-02	2.80E-02	1.85E-02	8
PU-238	PU	7.73E-05	8.35E-05	-9.72E-05	1.63E-04	1.04E-04	12
PU-239	PU	5.96E-05	9.13E-05	-1.53E-04	1.87E-04	8.18E-05	12
SR-90	SR	3.08E-04	6.71E-04	-5.00E-04	2.00E-03	1.00E-04	12
BI-214	GAMMA	5.70E-02	0.00E-01	5.70E-02	5.70E-02	5.70E-02	1
K-40	GAMMA	3.83E+00	1.80E+00	2.10E+00	1.20E+01	3.50E+00	24
PB-210	PB	7.67E-02	1.18E-01	-1.44E-01	4.81E-01	8.50E-02	24
PB-214	GAMMA	4.50E-02	0.00E-01	4.50E-02	4.50E-02	4.50E-02	1
PO-210	PO	4.95E-02	1.28E-01	-1.31E-03	6.05E-01	1.15E-02	24
RA-226	RA	2.17E-03	3.73E-04	2.00E-03	3.00E-03	2.00E-03	12
TH-227	TH	5.48E-05	1.35E-04	-2.10E-04	2.41E-04	2.56E-05	12
TH-228	TH	-7.51E-04	5.10E-04	-1.56E-03	-2.52E-04	-4.80E-04	12
TH-230	TH	1.88E-04	1.42E-04	0.00E-01	4.43E-04	1.57E-04	12
TH-232	TH	1.01E-04	9.19E-05	-5.04E-05	3.32E-04	1.05E-04	12
U-234	U	7.28E-04	4.44E-04	3.46E-05	1.93E-03	6.99E-04	12
U-235	U	4.73E-05	9.09E-05	-5.56E-05	2.41E-04	2.53E-05	12
U-238	U	3.68E-04	1.52E-04	2.81E-05	6.18E-04	3.81E-04	12

Radionuclide Analyses of Nonedible Biota Samples
1981 NOAA Sampling for EPA

pCi/g wet

NUCLIDE	ANALYSIS	MEAN	STD DEV	MINIMUM	MAXIMUM	MEDIAN	NUMBER
CS-137	GAMMA	8.05E-02	3.95E-02	4.10E-02	1.20E-01	8.05E-02	2
PU-238	PU	7.61E-03	6.88E-03	3.92E-04	1.80E-02	4.80E-03	5
PU-239	PU	4.24E-03	7.83E-03	-6.70E-03	1.60E-02	2.40E-03	5
SR-90	SR	-3.70E-03	1.67E-02	-3.60E-02	9.90E-03	3.00E-04	5
BI-214	GAMMA	4.96E-01	2.00E-01	2.30E-01	7.50E-01	5.50E-01	5
K-40	GAMMA	1.03E+01	7.87E+00	2.00E+00	2.10E+01	1.00E+01	9
PB-210	PB	5.71E-01	6.01E-01	2.00E-02	1.79E+00	3.84E-01	9
PB-214	GAMMA	5.68E-01	1.99E-01	3.30E-01	8.30E-01	6.10E-01	5
PO-210	PO	3.60E-01	2.50E-01	3.80E-03	6.78E-01	4.06E-01	8
RA-226	RA	2.34E-01	1.33E-01	3.00E-03	3.90E-01	2.48E-01	5
TH-227	TH	1.73E-02	1.22E-02	4.52E-04	3.57E-02	1.78E-02	5
TH-228	TH	2.36E-01	1.32E-01	-6.47E-04	4.00E-01	2.54E-01	5
TH-230	TH	1.49E-01	1.08E-01	2.48E-04	3.09E-01	1.72E-01	5
TH-232	GAMMA	1.44E+00	9.04E-01	6.60E-01	2.60E+00	7.60E-01	5
TH-232	TH	1.70E-01	1.29E-01	2.17E-04	3.66E-01	1.81E-01	5
U-234	U	2.15E-01	1.49E-01	1.85E-03	4.66E-01	1.89E-01	5
U-235	U	1.36E-02	1.20E-02	2.90E-04	3.40E-02	1.50E-02	5
U-238	U	1.89E-01	1.33E-01	8.69E-04	4.13E-01	1.72E-01	5
ALPHA	ALPHA	2.57E+00	1.16E+00	7.40E-01	3.74E+00	2.91E+00	4
BETA	BETA	2.34E+00	3.39E+00	-2.56E+00	6.35E+00	2.78E+00	4

Radionuclide Analyses of Sediment Samples
1981 NOAA Sampling for EPA

pCi/g dry

NUCLIDE	ANALYSIS	MEAN	STD DEV	MINIMUM	MAXIMUM	MEDIAN	NUMBER
CS-137	GAMMA	1.11E-01	7.23E-02	1.40E-02	3.62E-01	1.10E-01	22
PU-238	PU	2.87E-02	2.36E-02	0.00E-01	7.40E-02	2.23E-02	23
PU-239	PU	2.76E-02	2.35E-02	-1.10E-02	6.37E-02	1.90E-02	23
SR-90	SR	3.31E-02	6.43E-02	-1.00E-01	1.44E-01	4.00E-02	25
BI-214	GAMMA	6.90E-01	4.12E-01	1.00E-01	1.93E+00	6.80E-01	30
K-40	GAMMA	2.06E+01	1.21E+01	1.70E+00	6.69E+01	1.87E+01	30
PB-210	PB	3.17E+00	1.66E+00	9.49E-01	8.01E+00	2.76E+00	30
PB-214	GAMMA	7.39E-01	4.13E-01	1.20E-01	2.00E+00	7.10E-01	30
PO-210	PO	1.70E+00	9.48E-01	2.09E-01	4.35E+00	1.65E+00	30
RA-226	RA	8.74E-01	2.77E-01	1.40E-01	1.40E+00	9.70E-01	25
TH-227	TH	1.87E-01	1.52E-01	2.45E-04	5.37E-01	1.18E-01	23
TH-228	TH	8.32E-01	2.91E-01	1.69E-01	1.18E+00	9.19E-01	23
TH-230	TH	8.93E-01	3.34E-01	1.58E-01	1.50E+00	9.39E-01	23
TH-232	GAMMA	9.18E-01	5.43E-01	9.20E-02	2.79E+00	7.90E-01	30
TH-232	TH	9.93E-01	3.57E-01	1.51E-01	1.50E+00	1.11E+00	23
U-234	U	9.39E-01	3.04E-01	1.88E-01	1.40E+00	9.62E-01	23
U-235	U	5.59E-02	3.04E-02	1.64E-02	1.23E-01	4.90E-02	23
U-238	GAMMA	3.51E+00	2.50E+00	0.00E-01	8.64E+00	3.66E+00	9
U-238	U	8.09E-01	3.22E-01	1.74E-01	1.35E+00	8.73E-01	23
ALPHA	ALPHA	6.16E+00	3.51E+00	-4.00E-01	1.46E+01	6.20E+00	27
BETA	BETA	2.49E+01	1.60E+01	-1.39E+01	4.74E+01	2.95E+01	27

Radionuclide Analyses of FDA Marketplace Seafood Samples
1981 and 1982

pCi/g wet

NUCLIDE	ANALYSIS	MEAN	STD DEV	MINIMUM	MAXIMUM	MEDIAN	NUMBER
CS-137	GAMMA	1.71E-02	7.86E-03	5.00E-03	3.10E-02	1.50E-02	7
PU-238	PU	3.04E-04	4.32E-04	-1.00E-05	1.70E-03	1.08E-04	15
PU-239	PU	2.26E-05	1.04E-04	-3.00E-04	1.70E-04	2.14E-05	15
SR-90	SR	-4.19E-05	1.06E-03	-2.10E-03	2.60E-03	-2.00E-04	15
K-40	GAMMA	3.24E+00	3.42E-01	2.70E+00	3.90E+00	3.20E+00	15
PB-210	PB	1.95E-01	2.78E-01	-6.81E-02	1.06E+00	1.07E-01	15
PO-210	PO	6.38E-03	5.31E-03	4.00E-04	2.20E-02	5.50E-03	15
RA-226	RA	2.03E-03	5.96E-04	1.10E-03	3.00E-03	2.00E-03	15
TH-227	TH	2.34E-04	1.94E-04	-8.00E-05	6.99E-04	1.90E-04	14
TH-228	TH	-2.35E-04	3.61E-04	-1.01E-03	4.56E-04	-1.22E-04	14
TH-230	TH	4.18E-04	1.63E-04	1.95E-04	7.00E-04	4.06E-04	14
TH-232	TH	1.75E-04	6.43E-05	8.90E-05	3.00E-04	2.00E-04	14
U-234	U	1.13E-03	1.04E-03	4.46E-04	4.62E-03	8.49E-04	14
U-235	U	9.65E-04	3.37E-03	-3.76E-04	1.31E-02	5.49E-05	14
U-238	U	6.14E-04	3.16E-04	2.37E-04	1.31E-03	5.50E-04	14
ALPHA	ALPHA	-5.71E-02	5.28E-02	-1.50E-01	-2.00E-02	-3.00E-02	7
BETA	BETA	3.84E+00	3.42E-01	3.10E+00	4.20E+00	4.00E+00	7

Radionuclide Analyses of Edible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

MAN-MADE NUCLIDES pCi/g wet

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
CO-60	MEAN	1.00E-02	1.35E-02	0.00E-01	2.00E-02	0.00E-01	1.43E-02
	ST DEV	0.00E-01	3.50E-03	0.00E-01	0.00E-01	0.00E-01	4.38E-03
	MAX	1.00E-02	1.70E-02	0.00E-01	2.00E-02	0.00E-01	2.00E-02
	MIN	1.00E-02	1.00E-02	0.00E-01	2.00E-02	0.00E-01	1.00E-02
	MEDIAN	1.00E-02	1.35E-02	0.00E-01	2.00E-02	0.00E-01	1.35E-02
	NUMBER(1)	44	12	8	26	1	91
	NUMBER(2)	1	2	0	1	0	4
CS-137	MEAN	3.47E-02	0.00E-01	0.00E-01	1.60E-02	0.00E-01	3.27E-02
	ST DEV	3.15E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	3.02E-02
	MAX	9.70E-02	0.00E-01	0.00E-01	1.60E-02	0.00E-01	9.70E-02
	MIN	1.00E-02	0.00E-01	0.00E-01	1.60E-02	0.00E-01	1.00E-02
	MEDIAN	1.45E-02	0.00E-01	0.00E-01	1.60E-02	0.00E-01	1.60E-02
	NUMBER(1)	44	12	8	26	1	91
	NUMBER(2)	8	0	0	1	0	9
PU-238	MEAN	3.30E-04	2.52E-03	1.74E-04	6.58E-04	0.00E-01	5.58E-04
	ST DEV	5.07E-04	2.88E-03	1.53E-05	6.03E-04	0.00E-01	1.00E-03
	MAX	2.12E-03	6.59E-03	1.89E-04	2.10E-03	0.00E-01	6.59E-03
	MIN	-5.95E-04	2.45E-04	1.59E-04	7.23E-05	0.00E-01	-5.95E-04
	MEDIAN	2.84E-04	7.40E-04	1.74E-04	4.32E-04	0.00E-01	3.46E-04
	NUMBER	30	3	2	17	0	52
PU-239	MEAN	6.30E-05	8.67E-04	3.69E-04	2.70E-04	0.00E-01	1.89E-04
	ST DEV	2.17E-04	9.23E-04	3.69E-04	4.06E-04	0.00E-01	4.18E-04
	MAX	9.54E-04	2.16E-03	7.38E-04	1.73E-03	0.00E-01	2.16E-03
	MIN	-2.63E-04	5.82E-05	0.00E-01	-2.49E-05	0.00E-01	-2.63E-04
	MEDIAN	1.37E-05	3.83E-04	3.69E-04	1.18E-04	0.00E-01	6.97E-05
	NUMBER	30	3	2	17	0	52
SR-90	MEAN	-3.26E-04	2.10E-03	-2.65E-04	-1.38E-03	0.00E-01	-4.91E-04
	ST DEV	2.94E-03	1.23E-03	2.35E-04	2.94E-03	0.00E-01	2.92E-03
	MAX	5.80E-03	3.70E-03	-3.00E-05	3.00E-03	0.00E-01	5.80E-03
	MIN	-7.00E-03	7.00E-04	-5.00E-04	-6.10E-03	0.00E-01	-7.00E-03
	MEDIAN	-1.00E-03	1.90E-03	-2.65E-04	-1.00E-03	0.00E-01	-1.00E-03
	NUMBER	26	3	2	14	0	45

Radionuclide Analyses of Edible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

NATURAL NUCLIDES pCi/g wet

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
BI-214	MEAN	1.05E-01	0.00E-01	0.00E-01	0.00E-01	4.20E-02	9.47E-02
	ST DEV	4.73E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	4.92E-02
	MAX	1.60E-01	0.00E-01	0.00E-01	0.00E-01	4.20E-02	1.60E-01
	MIN	2.00E-02	0.00E-01	0.00E-01	0.00E-01	4.20E-02	2.00E-02
	MEDIAN	1.20E-01	0.00E-01	0.00E-01	0.00E-01	4.20E-02	1.08E-01
	NUMBER(1)	44	12	8	26	1	91
	NUMBER(2)	5	0	0	0	1	6
K-40	MEAN	3.07E+00	3.32E+00	3.28E+00	2.88E+00	3.20E+00	3.06E+00
	ST DEV	5.35E-01	7.45E-01	3.93E-01	6.28E-01	0.00E-01	6.00E-01
	MAX	4.10E+00	5.10E+00	3.80E+00	4.70E+00	3.20E+00	5.10E+00
	MIN	1.60E+00	2.00E+00	2.70E+00	1.50E+00	3.20E+00	1.50E+00
	MEDIAN	3.10E+00	3.35E+00	3.25E+00	3.00E+00	3.20E+00	3.10E+00
	NUMBER(1)	44	12	8	26	1	91
	NUMBER(2)	44	12	8	26	1	91
PB-210	MEAN	2.50E-02	-8.57E-02	1.40E-01	1.92E-02	-2.94E-03	2.15E-02
	ST DEV	1.25E-01	1.47E-01	1.33E-01	1.29E-01	0.00E-01	1.37E-01
	MAX	3.38E-01	8.54E-02	2.87E-01	2.69E-01	-2.94E-03	3.38E-01
	MIN	-3.55E-01	-2.79E-01	-3.94E-02	-3.57E-01	-2.94E-03	-3.57E-01
	MEDIAN	1.36E-02	-1.11E-01	1.80E-01	4.61E-02	-2.94E-03	2.50E-02
	NUMBER	37	7	6	25	1	76
PB-214	MEAN	9.58E-02	0.00E-01	0.00E-01	0.00E-01	3.70E-02	8.60E-02
	ST DEV	4.20E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	4.41E-02
	MAX	1.50E-01	0.00E-01	0.00E-01	0.00E-01	3.70E-02	1.50E-01
	MIN	2.40E-02	0.00E-01	0.00E-01	0.00E-01	3.70E-02	2.40E-02
	MEDIAN	1.00E-01	0.00E-01	0.00E-01	0.00E-01	3.70E-02	9.25E-02
	NUMBER(1)	44	12	8	26	1	91
	NUMBER(2)	5	0	0	0	1	6
PO-210	MEAN	8.44E-02	1.57E-01	3.84E-02	8.50E-02	3.70E-02	8.70E-02
	ST DEV	1.11E-01	1.85E-01	5.86E-02	7.99E-02	0.00E-01	1.10E-01
	MAX	3.66E-01	4.62E-01	1.67E-01	3.15E-01	3.70E-02	4.62E-01
	MIN	-3.42E-04	1.73E-02	2.40E-04	1.42E-02	3.70E-02	-3.42E-04
	MEDIAN	1.73E-02	5.38E-02	1.25E-02	4.90E-02	3.70E-02	3.18E-02
	NUMBER	37	7	6	26	1	77
RA-226	MEAN	1.11E-02	8.29E-03	3.83E-03	9.74E-03	1.00E-02	9.74E-03
	ST DEV	1.10E-02	7.50E-03	2.91E-03	9.88E-03	0.00E-01	9.98E-03
	MAX	4.00E-02	2.00E-02	1.00E-02	3.00E-02	1.00E-02	4.00E-02
	MIN	2.00E-03	2.00E-03	1.00E-03	1.00E-03	1.00E-02	1.00E-03
	MEDIAN	5.00E-03	4.00E-03	3.00E-03	5.00E-03	1.00E-02	5.00E-03
	NUMBER	33	7	6	23	1	70
TH-227	MEAN	1.02E-03	1.10E-03	3.64E-04	4.79E-03	0.00E-01	2.01E-03
	ST DEV	1.71E-03	1.20E-03	5.09E-04	1.39E-02	0.00E-01	7.59E-03
	MAX	4.68E-03	3.52E-03	1.00E-03	5.82E-02	0.00E-01	5.82E-02
	MIN	-4.03E-03	5.37E-05	-4.12E-04	-1.76E-04	0.00E-01	-4.03E-03
	MEDIAN	5.38E-04	4.93E-04	2.61E-04	6.33E-04	0.00E-01	5.10E-04
	NUMBER	30	7	5	16	0	58

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NUCLIDE              AREA 1     AREA 2     AREA 3     AREA 4     AREA 5      TOTAL

TH-228   MEAN     2.85E-03   2.72E-03   1.19E-03   2.90E-02   0.00E-01   9.91E-03
       ST DEV     1.42E-02   2.92E-03   1.33E-03   9.20E-02   0.00E-01   5.08E-02
          MAX     2.89E-02   7.91E-03   3.72E-03   3.84E-01   0.00E-01   3.84E-01
          MIN    -6.24E-02   1.51E-04   1.29E-04  -6.19E-03   0.00E-01  -6.24E-02
       MEDIAN     1.24E-03   1.05E-03   7.14E-04   2.88E-03   0.00E-01   1.29E-03
       NUMBER           30          7          5         16          0         58

TH-230   MEAN     6.35E-03   3.01E-03   1.34E-03   2.52E-02   0.00E-01   1.07E-02
       ST DEV     9.13E-03   3.42E-03   1.13E-03   8.09E-02   0.00E-01   4.39E-02
          MAX     3.65E-02   8.81E-03   3.45E-03   3.38E-01   0.00E-01   3.38E-01
          MIN    -2.35E-04   2.32E-04   3.39E-04   7.02E-04   0.00E-01  -2.35E-04
       MEDIAN     1.77E-03   6.81E-04   7.11E-04   3.14E-03   0.00E-01   1.84E-03
       NUMBER           30          7          5         16          0         58

ANALYSIS=GAMMA

TH-232   MEAN     8.80E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.80E-02
       ST DEV     0.00E-01   0.00E-01   0.00E-01   0.00E-01   0.00E-01   0.00E-01
          MAX     8.80E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.80E-02
          MIN     8.80E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.80E-02
       MEDIAN     8.80E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.80E-02
    NUMBER(1)           44         12          8         26          1         91
    NUMBER(2)            1          0          0          0          0          1

ANALYSIS=TH

TH-232   MEAN     4.94E-03   2.98E-03   1.26E-03   2.69E-02   0.00E-01   1.05E-02
       ST DEV     7.43E-03   3.57E-03   1.27E-03   8.80E-02   0.00E-01   4.77E-02
          MAX     2.72E-02   9.45E-03   3.61E-03   3.67E-01   0.00E-01   3.67E-01
          MIN     0.00E-01   5.15E-05   2.77E-04   4.21E-04   0.00E-01   0.00E-01
       MEDIAN     1.15E-03   6.30E-04   5.27E-04   2.77E-03   0.00E-01   1.54E-03
       NUMBER           30          7          5         16          0         58

U-234    MEAN     2.60E-02   1.08E-02   9.56E-04   8.00E-03   0.00E-01   1.64E-02
       ST DEV     6.31E-02   1.00E-03   1.12E-04   7.89E-03   0.00E-01   4.48E-02
          MAX     2.89E-01   1.18E-02   1.07E-03   2.84E-02   0.00E-01   2.89E-01
          MIN     1.10E-03   9.83E-03   8.43E-04   1.47E-03   0.00E-01   8.43E-04
       MEDIAN     3.99E-03   1.08E-02   9.56E-04   4.70E-03   0.00E-01   4.39E-03
       NUMBER           20          2          2         18          0         42

U-235    MEAN     1.19E-03   5.34E-04   9.19E-05   7.00E-04   0.00E-01   8.95E-04
       ST DEV     3.39E-03   1.94E-04   8.40E-05   9.88E-04   0.00E-01   2.45E-03
          MAX     1.57E-02   7.28E-04   1.76E-04   3.00E-03   0.00E-01   1.57E-02
          MIN     0.00E-01   3.39E-04   7.91E-06  -4.15E-05   0.00E-01  -4.15E-05
       MEDIAN     2.49E-04   5.34E-04   9.19E-05   1.57E-04   0.00E-01   2.16E-04
       NUMBER           20          2          2         18          0         42

ANALYSIS=U

U-238    MEAN     1.88E-02   8.25E-03   8.56E-04   7.73E-03   0.00E-01   1.27E-02
       ST DEV     4.22E-02   5.02E-04   3.94E-04   7.32E-03   0.00E-01   3.01E-02
          MAX     1.94E-01   8.75E-03   1.25E-03   2.62E-02   0.00E-01   1.94E-01
          MIN     8.41E-04   7.75E-03   4.61E-04   1.28E-03   0.00E-01   4.61E-04
       MEDIAN     3.99E-03   8.25E-03   8.56E-04   5.31E-03   0.00E-01   4.18E-03
       NUMBER           20          2          2         18          0         42
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Radionuclide Analyses of Edible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

pCi/g wet

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
ALPHA	MEAN	-2,98E-02	-4.50E-02	-8,75E-02	-2,23E-01	1,00E-01	-9,35E-02
	ST DEV	1,25E-01	6.38E-02	2,66E-01	3,93E-01	0,00E-01	2.61E-01
	MAX	3,00E-01	2.00E-02	3,00E-01	4,00E-01	1,00E-01	4.00E-01
	MIN	-4.00E-01	-2.00E-01	-7,00E-01	-1,20E+00	1.00E-01	-1,20E+00
	MEDIAN	-2,00E-02	-2.00E-02	-4,00E-02	-1,00E-01	1.00E-01	-4,00E-02
	NUMBER	44	12	8	28	1	93
BETA	MEAN	4.08E+00	3.41E+00	5.20E+00	8,87E+00	2.70E+00	5,50E+00
	ST DEV	2.04E+00	9.17E-01	3,70E+00	7,20E+00	0,00E-01	4,87E+00
	MAX	1.70E+01	4.50E+00	1.49E+01	2,14E+01	2,70E+00	2,14E+01
	MIN	2.30E+00	1.50E+00	2,80E+00	2,10E+00	2.70E+00	1.50E+00
	MEDIAN	3.80E+00	3.80E+00	3.95E+00	4,20E+00	2.70E+00	3,90E+00
	NUMBER	45	12	8	28	1	94

Radionuclide Analyses of Nonedible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

MAN-MADE NUCLIDES pCi/g wet

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
CO-60	MEAN	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	ST DEV	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MAX	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MIN	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MEDIAN	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	NUMBER(1)	11	1	3	6	0	21
	NUMBER(2)	0	1	0	0	0	1
CS-137	MEAN	3.70E-02	5.00E-03	0.00E-01	0.00E-01	0.00E-01	2.63E-02
	ST DEV	2.50E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	2.54E-02
	MAX	6.20E-02	5.00E-03	0.00E-01	0.00E-01	0.00E-01	6.20E-02
	MIN	1.20E-02	5.00E-03	0.00E-01	0.00E-01	0.00E-01	5.00E-03
	MEDIAN	3.70E-02	5.00E-03	0.00E-01	0.00E-01	0.00E-01	1.20E-02
	NUMBER(1)	11	1	3	6	0	21
	NUMBER(2)	2	1	0	0	0	3
PU-238	MEAN	5.71E-05	7.16E-01	3.08E-04	6.81E-04	0.00E-01	6.00E-02
	ST DEV	2.17E-04	0.00E-01	0.00E-01	7.35E-04	0.00E-01	1.98E-01
	MAX	5.12E-04	7.16E-01	3.08E-04	1.73E-03	0.00E-01	7.16E-01
	MIN	-1.74E-04	7.16E-01	3.08E-04	-2.87E-04	0.00E-01	-2.87E-04
	MEDIAN	2.38E-05	7.16E-01	3.08E-04	6.40E-04	0.00E-01	1.72E-04
	NUMBER	6	1	1	4	0	12
PU-239	MEAN	2.54E-05	4.31E-03	1.21E-04	6.37E-05	0.00E-01	4.03E-04
	ST DEV	7.37E-05	0.00E-01	0.00E-01	1.25E-04	0.00E-01	1.18E-03
	MAX	1.22E-04	4.31E-03	1.21E-04	2.56E-04	0.00E-01	4.31E-03
	MIN	-7.70E-05	4.31E-03	1.21E-04	-5.39E-05	0.00E-01	-7.70E-05
	MEDIAN	3.77E-05	4.31E-03	1.21E-04	2.62E-05	0.00E-01	7.26E-05
	NUMBER	6	1	1	4	0	12
SR-90	MEAN	-3.15E-03	-7.00E-04	0.00E-01	-7.50E-03	0.00E-01	-3.84E-03
	ST DEV	4.18E-03	0.00E-01	0.00E-01	2.50E-03	0.00E-01	4.18E-03
	MAX	7.00E-04	-7.00E-04	0.00E-01	-5.00E-03	0.00E-01	7.00E-04
	MIN	-1.10E-02	-7.00E-04	0.00E-01	-1.00E-02	0.00E-01	-1.10E-02
	MEDIAN	-1.24E-03	-7.00E-04	0.00E-01	-7.50E-03	0.00E-01	-1.50E-03
	NUMBER	6	1	0	2	0	9

Radionuclide Analyses of Nonedible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

NATURAL NUCLIDES

pCi/g wet

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
BI-214	MEAN	7.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	7.00E-02
	ST DEV	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MAX	7.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	7.00E-02
	MIN	7.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	7.00E-02
	MEDIAN	7.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	7.00E-02
	NUMBER(1)	11	1	3	6	0	21
	NUMBER(2)	1	0	0	0	0	1
K-40	MEAN	2.91E+00	1.40E+00	1.32E+00	7.95E-01	0.00E-01	2.13E+00
	ST DEV	1.02E+00	0.00E-01	6.79E-01	3.18E-01	0.00E-01	1.24E+00
	MAX	5.20E+00	1.40E+00	1.80E+00	1.20E+00	0.00E-01	5.20E+00
	MIN	1.50E+00	1.40E+00	3.60E-01	4.10E-01	0.00E-01	3.60E-01
	MEDIAN	2.80E+00	1.40E+00	1.80E+00	7.85E-01	0.00E-01	1.80E+00
	NUMBER(1)	11	1	3	6	0	21
	NUMBER(2)	11	1	3	4	0	19
PB-210	MEAN	2.01E-02	-7.45E-03	9.03E-03	-1.06E-02	0.00E-01	7.70E-03
	ST DEV	7.92E-02	0.00E-01	0.00E-01	7.20E-02	0.00E-01	7.19E-02
	MAX	1.61E-01	-7.45E-03	9.03E-03	9.28E-02	0.00E-01	1.61E-01
	MIN	-6.48E-02	-7.45E-03	9.03E-03	-1.10E-01	0.00E-01	-1.10E-01
	MEDIAN	-1.81E-02	-7.45E-03	9.03E-03	-1.26E-02	0.00E-01	-7.45E-03
	NUMBER	7	1	1	4	0	13
PB-214	MEAN	6.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.00E-02
	ST DEV	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MAX	6.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.00E-02
	MIN	6.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.00E-02
	MEDIAN	6.00E-02	0.00E-01	0.00E-01	0.00E-01	0.00E-01	6.00E-02
	NUMBER(1)	11	1	3	6	0	21
	NUMBER(2)	1	0	0	0	0	1
PO-210	MEAN	2.65E-02	9.82E-02	2.82E-03	9.06E-03	0.00E-01	2.48E-02
	ST DEV	1.40E-02	0.00E-01	0.00E-01	2.89E-03	0.00E-01	2.53E-02
	MAX	5.19E-02	9.82E-02	2.82E-03	1.24E-02	0.00E-01	9.82E-02
	MIN	5.61E-03	9.82E-02	2.82E-03	5.66E-03	0.00E-01	2.82E-03
	MEDIAN	2.36E-02	9.82E-02	2.82E-03	9.12E-03	0.00E-01	1.65E-02
	NUMBER	7	1	1	4	0	13
RA-226	MEAN	1.00E-02	8.00E-03	6.00E-03	3.75E-03	0.00E-01	7.62E-03
	ST DEV	8.75E-03	0.00E-01	0.00E-01	2.28E-03	0.00E-01	7.12E-03
	MAX	3.00E-02	8.00E-03	6.00E-03	6.00E-03	0.00E-01	3.00E-02
	MIN	2.00E-03	8.00E-03	6.00E-03	1.00E-03	0.00E-01	1.00E-03
	MEDIAN	1.00E-02	8.00E-03	6.00E-03	4.00E-03	0.00E-01	6.00E-03
	NUMBER	7	1	1	4	0	13
TH-227	MEAN	5.08E-04	-1.56E-03	1.61E-03	2.40E-04	0.00E-01	3.47E-04
	ST DEV	2.62E-04	0.00E-01	0.00E-01	2.70E-04	0.00E-01	7.42E-04
	MAX	8.50E-04	-1.56E-03	1.61E-03	6.18E-04	0.00E-01	1.61E-03
	MIN	1.29E-04	-1.56E-03	1.61E-03	0.00E-01	0.00E-01	-1.56E-03
	MEDIAN	5.04E-04	-1.56E-03	1.61E-03	1.02E-04	0.00E-01	3.58E-04
	NUMBER	6	1	1	3	0	11

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NUCLIDE              AREA 1     AREA 2     AREA 3     AREA 4     AREA 5      TOTAL

TH-228   MEAN      1.79E-03   2.02E-02   9.70E-03  -3.04E-04   0.00E-01   3.61E-03
         ST DEV    1.50E-03   0.00E-01   0.00E-01   8.20E-04   0.00E-01   5.97E-03
           MAX     3.65E-03   2.02E-02   9.70E-03   7.81E-04   0.00E-01   2.02E-02
           MIN    -7.38E-04   2.02E-02   9.70E-03  -1.20E-03   0.00E-01  -1.20E-03
         MEDIAN    1.84E-03   2.02E-02   9.70E-03  -4.93E-04   0.00E-01   1.57E-03
         NUMBER           6          1          1          3          0         11

TH-230   MEAN      2.41E-03   2.02E-02   3.82E-03   4.89E-04   0.00E-01   3.64E-03
         ST DEV    1.71E-03   0.00E-01   0.00E-01   3.29E-04   0.00E-01   5.49E-03
           MAX     5.85E-03   2.02E-02   3.82E-03   9.41E-04   0.00E-01   2.02E-02
           MIN     5.85E-04   2.02E-02   3.82E-03   1.71E-04   0.00E-01   1.71E-04
         MEDIAN    2.12E-03   2.02E-02   3.82E-03   3.56E-04   0.00E-01   1.80E-03
         NUMBER           6          1          1          3          0         11

ANALYSIS=GAMMA

TH-232   MEAN      8.00E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.00E-02
         ST DEV    0.00E-01   0.00E-01   0.00E-01   0.00E-01   0.00E-01   0.00E-01
           MAX     8.00E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.00E-02
           MIN     8.00E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.00E-02
         MEDIAN    8.00E-02   0.00E-01   0.00E-01   0.00E-01   0.00E-01   8.00E-02
       NUMBER(1)         11          1          3          6          0         21
       NUMBER(2)          1          0          0          0          0          1

ANALYSIS=TH

TH-232   MEAN      1.68E-03   1.05E-02   3.63E-03   1.78E-04   0.00E-01   2.25E-03
         ST DEV    1.51E-03   0.00E-01   0.00E-01   2.57E-05   0.00E-01   2.99E-03
           MAX     4.90E-03   1.05E-02   3.63E-03   2.09E-04   0.00E-01   1.05E-02
           MIN     5.04E-04   1.05E-02   3.63E-03   1.46E-04   0.00E-01   1.46E-04
         MEDIAN    1.10E-03   1.05E-02   3.63E-03   1.78E-04   0.00E-01   9.74E-04
         NUMBER           6          1          1          3          0         11

U-234    MEAN      5.27E-03   1.08E-02   1.10E-02   1.81E-02   0.00E-01   1.05E-02
         ST DEV    2.49E-03   0.00E-01   0.00E-01   9.66E-03   0.00E-01   8.21E-03
           MAX     9.69E-03   1.08E-02   1.10E-02   3.36E-02   0.00E-01   3.36E-02
           MIN     8.92E-04   1.08E-02   1.10E-02   7.93E-03   0.00E-01   8.92E-04
         MEDIAN    5.65E-03   1.08E-02   1.10E-02   1.55E-02   0.00E-01   8.31E-03
         NUMBER           6          1          1          4          0         12

U-235    MEAN      5.85E-04   3.19E-04   8.04E-04   6.49E-04   0.00E-01   6.03E-04
         ST DEV    4.61E-04   0.00E-01   0.00E-01   1.82E-04   0.00E-01   3.58E-04
           MAX     1.30E-03   3.19E-04   8.04E-04   7.89E-04   0.00E-01   1.30E-03
           MIN     3.79E-05   3.19E-04   8.04E-04   3.45E-04   0.00E-01   3.79E-05
         MEDIAN    5.46E-04   3.19E-04   8.04E-04   7.32E-04   0.00E-01   7.32E-04
         NUMBER           6          1          1          4          0         12

ANALYSIS=U

U-238    MEAN      2.94E-03   7.16E-03   7.56E-03   1.19E-02   0.00E-01   6.68E-03
         ST DEV    1.37E-03   0.00E-01   0.00E-01   6.61E-03   0.00E-01   5.64E-03
           MAX     4.84E-03   7.16E-03   7.56E-03   2.32E-02   0.00E-01   2.32E-02
           MIN     1.21E-03   7.16E-03   7.56E-03   6.55E-03   0.00E-01   1.21E-03
         MEDIAN    2.96E-03   7.16E-03   7.56E-03   9.02E-03   0.00E-01   5.69E-03
         NUMBER           6          1          1          4          0         12
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Radionuclide Analyses of Nonedible Biota Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

pCi/g wet

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
ALPHA	MEAN	-1.09E-01	1.00E-01	0.00E-01	-3.10E-01	0.00E-01	-1.25E-01
	ST DEV	9.76E-02	0.00E-01	8.16E-03	2.98E-01	0.00E-01	2.00E-01
	MAX	0.00E-01	1.00E-01	1.00E-02	-2.00E-02	0.00E-01	1.00E-01
	MIN	-3.00E-01	1.00E-01	-1.00E-02	-7.00E-01	0.00E-01	-7.00E-01
	MEDIAN	-1.00E-01	1.00E-01	0.00E-01	-2.60E-01	0.00E-01	-2.00E-02
	NUMBER	9	1	3	4	0	17
BETA	MEAN	3.69E+00	2.20E+00	1.80E+00	6.87E+00	0.00E-01	4.02E+00
	ST DEV	9.28E-01	0.00E-01	1.19E+00	6.08E+00	0.00E-01	3.53E+00
	MAX	4.90E+00	2.20E+00	3.30E+00	1.32E+01	0.00E-01	1.32E+01
	MIN	2.10E+00	2.20E+00	4.00E-01	8.00E-01	0.00E-01	4.00E-01
	MEDIAN	3.80E+00	2.20E+00	1.70E+00	6.75E+00	0.00E-01	3.30E+00
	NUMBER	9	1	3	4	0	17

Radionuclide Analyses of Sediment Samples
EPA Radiological Monitoring Survey
Massachusetts Bay 1982

MAN-MADE NUCLIDES pCi/g dry

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
CO-60	MEAN	0.00E-01	0.00E-01	0.00E-01	1.94E-02	0.00E-01	1.94E-02
	ST DEV	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MAX	0.00E-01	0.00E-01	0.00E-01	1.94E-02	0.00E-01	1.94E-02
	MIN	0.00E-01	0.00E-01	0.00E-01	1.94E-02	0.00E-01	1.94E-02
	MEDIAN	0.00E-01	0.00E-01	0.00E-01	1.94E-02	0.00E-01	1.94E-02
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	0	0	0	1	0	1
CS-134	MEAN	0.00E-01	5.03E-02	0.00E-01	0.00E-01	0.00E-01	5.03E-02
	ST DEV	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01
	MAX	0.00E-01	5.03E-02	0.00E-01	0.00E-01	0.00E-01	5.03E-02
	MIN	0.00E-01	5.03E-02	0.00E-01	0.00E-01	0.00E-01	5.03E-02
	MEDIAN	0.00E-01	5.03E-02	0.00E-01	0.00E-01	0.00E-01	5.03E-02
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	0	1	0	0	0	1
CS-137	MEAN	1.18E-01	6.06E-02	1.09E-01	9.09E-02	3.10E-02	9.76E-02
	ST DEV	3.40E-02	2.70E-02	1.13E-01	2.15E-02	0.00E-01	5.39E-02
	MAX	2.23E-01	1.10E-01	5.02E-01	1.30E-01	3.10E-02	5.02E-01
	MIN	3.14E-02	1.16E-02	2.80E-02	3.15E-02	3.10E-02	1.16E-02
	MEDIAN	1.20E-01	6.00E-02	9.00E-02	9.30E-02	3.10E-02	9.60E-02
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	43	21	14	28	1	107
MN-54	MEAN	1.69E-02	8.60E-03	1.48E-02	0.00E-01	0.00E-01	1.35E-02
	ST DEV	0.00E-01	0.00E-01	0.00E-01	0.00E-01	0.00E-01	3.54E-03
	MAX	1.69E-02	8.60E-03	1.48E-02	0.00E-01	0.00E-01	1.69E-02
	MIN	1.69E-02	8.60E-03	1.48E-02	0.00E-01	0.00E-01	8.60E-03
	MEDIAN	1.69E-02	8.60E-03	1.48E-02	0.00E-01	0.00E-01	1.48E-02
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	1	1	1	0	0	3
PU-238	MEAN	1.26E-02	1.25E-02	1.01E-02	1.80E-02	1.69E-02	1.46E-02
	ST DEV	7.07E-03	1.06E-02	1.07E-02	3.80E-02	0.00E-01	2.51E-02
	MAX	3.01E-02	3.52E-02	3.23E-02	2.12E-01	1.69E-02	2.12E-01
	MIN	3.39E-04	6.53E-05	1.16E-03	-7.80E-03	1.69E-02	-7.80E-03
	MEDIAN	1.30E-02	1.15E-02	6.98E-03	1.17E-02	1.69E-02	1.15E-02
	NUMBER	28	7	6	28	1	70
PU-239	MEAN	3.58E-02	2.48E-02	3.19E-02	3.89E-02	8.36E-03	3.52E-02
	ST DEV	2.50E-02	1.10E-02	1.01E-02	2.02E-02	0.00E-01	2.15E-02
	MAX	9.41E-02	3.88E-02	4.78E-02	8.16E-02	8.36E-03	9.41E-02
	MIN	0.00E-01	4.23E-04	1.66E-02	7.30E-03	8.36E-03	0.00E-01
	MEDIAN	3.24E-02	2.57E-02	3.07E-02	3.55E-02	8.36E-03	3.15E-02
	NUMBER	28	7	6	28	1	70
SR-90	MEAN	5.51E-02	5.42E-02	7.21E-02	-2.52E-02	0.00E-01	2.26E-02
	ST DEV	4.01E-02	1.07E-02	5.02E-02	6.51E-02	0.00E-01	6.52E-02
	MAX	1.71E-01	6.48E-02	1.40E-01	9.52E-02	0.00E-01	1.71E-01
	MIN	8.32E-03	4.35E-02	2.00E-02	-1.84E-01	0.00E-01	-1.84E-01
	MEDIAN	4.54E-02	5.42E-02	5.64E-02	-1.80E-02	0.00E-01	2.75E-02
	NUMBER	25	2	3	21	1	52

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NATURAL NUCLIDES pCi/g dry

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
BE-7	MEAN	1,05E-01	0.00E-01	0,00E-01	4,43E-01	0,00E-01	2,74E-01
	ST DEV	0,00E-01	0.00E-01	0.00E-01	0,00E-01	0,00E-01	1,69E-01
	MAX	1,05E-01	0,00E-01	0,00E-01	4,43E-01	0,00E-01	4,43E-01
	MIN	1,05E-01	0,00E-01	0,00E-01	4,43E-01	0,00E-01	1,05E-01
	MEDIAN	1,05E-01	0.00E-01	0,00E-01	4,43E-01	0,00E-01	2,74E-01
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	1	0	0	1	0	2
BI-214	MEAN	7,81E-01	8.17E-01	7,45E-01	7,52E-01	6,20E-01	7.74E-01
	ST DEV	1,73E-01	1.74E-01	1,41E-01	8,20E-02	3,85E-02	1,54E-01
	MAX	1,33E+00	1,50E+00	1,06E+00	8,84E-01	6,58E-01	1,50E+00
	MIN	3,57E-01	5.95E-01	4,30E-01	5,47E-01	5,81E-01	3,57E-01
	MEDIAN	7,80E-01	7.60E-01	7,40E-01	7,60E-01	6,20E-01	7,60E-01
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	47	23	15	28	2	115
K-40	MEAN	1,99E+01	2.02E+01	2,06E+01	2,02E+01	1,64E+01	2,01E+01
	ST DEV	2,26E+00	6.17E+00	4,80E+00	3,87E+00	0.00E-01	4,08E+00
	MAX	2,72E+01	4.47E+01	3,38E+01	2,44E+01	1,64E+01	4.47E+01
	MIN	1,39E+01	1,51E+01	1,46E+01	9,14E-01	1,64E+01	9,14E-01
	MEDIAN	2.00E+01	1,89E+01	1,97E+01	2,08E+01	1.64E+01	2,00E+01
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	47	23	15	28	2	115
PB-210	MEAN	3.54E+00	1.00E+00	1,59E+00	3,03E+00	1,20E+00	2,82E+00
	ST DEV	1,38E+00	8.50E-01	5,23E-01	1,03E+00	0.00E-01	1,34E+00
	MAX	5,24E+00	1.85E+00	2,31E+00	4,81E+00	1,20E+00	5,24E+00
	MIN	5,92E-01	1.51E-01	1,09E+00	1,03E+00	1.20E+00	1,51E-01
	MEDIAN	3.49E+00	1,00E+00	1,37E+00	2,94E+00	1.20E+00	2,88E+00
	NUMBER	8	2	3	15	1	29
PB-214	MEAN	8,31E-01	8,71E-01	7,78E-01	7,90E-01	6,42E-01	8,18E-01
	ST DEV	1,63E-01	1,82E-01	1,41E-01	1,48E-01	3,10E-02	1,64E-01
	MAX	1,35E+00	1,60E+00	1,03E+00	9,42E-01	6,73E-01	1,60E+00
	MIN	3,57E-01	6,82E-01	4,20E-01	7,48E-02	6,11E-01	7,48E-02
	MEDIAN	8,15E-01	8,30E-01	7,60E-01	8,20E-01	6,42E-01	8,14E-01
	NUMBER(1)	47	23	15	28	2	115
	NUMBER(2)	47	23	15	28	2	115
PO-210	MEAN	2,43E+00	1,88E+00	1,87E+00	2,62E+00	1,14E+00	2,39E+00
	ST DEV	5,38E-01	1,02E-01	3,14E-01	3,78E-01	0,00E-01	5,40E-01
	MAX	3,26E+00	1,99E+00	2,22E+00	3,19E+00	1,14E+00	3,26E+00
	MIN	1,54E+00	1,78E+00	1,46E+00	1,88E+00	1,14E+00	1,14E+00
	MEDIAN	2,47E+00	1,88E+00	1,94E+00	2,59E+00	1,14E+00	2,45E+00
	NUMBER	8	2	3	15	1	29
RA-226	MEAN	1,00E+00	9,22E-01	9,97E-01	9,72E-01	7,45E-01	9,78E-01
	ST DEV	2,90E-01	1,49E-01	1,21E-01	1,29E-01	0,00E-01	2,11E-01
	MAX	1,84E+00	1,07E+00	1,20E+00	1,22E+00	7,45E-01	1,84E+00
	MIN	4,62E-01	6,00E-01	7,89E-01	7,70E-01	7,45E-01	4,62E-01
	MEDIAN	9,80E-01	9,72E-01	9,93E-01	9,40E-01	7,45E-01	9,72E-01
	NUMBER	27	7	6	28	1	69

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NUCLIDE              AREA 1      AREA 2      AREA 3      AREA 4      AREA 5       TOTAL
TH-227   MEAN      2.37E-01    1.77E-01    2.11E-01    1.55E-01    9.00E-02    1.92E-01
       ST DEV      1.31E-01    3.07E-02    6.60E-02    7.34E-02    0.00E-01    1.03E-01
          MAX      5.98E-01    2.23E-01    3.14E-01    3.42E-01    9.00E-02    5.98E-01
          MIN      5.52E-02    1.46E-01    9.65E-02    4.23E-02    9.00E-02    4.23E-02
       MEDIAN      2.13E-01    1.66E-01    2.19E-01    1.42E-01    9.00E-02    1.72E-01
       NUMBER            23           6           6          26           1          62
TH-228   MEAN      1.02E+00    8.75E-01    1.02E+00    1.03E+00    7.63E-01    1.00E+00
       ST DEV      2.22E-01    1.24E-01    1.50E-01    1.01E-01    0.00E-01    1.71E-01
          MAX      1.54E+00    1.12E+00    1.25E+00    1.20E+00    7.63E-01    1.54E+00
          MIN      4.33E-01    7.17E-01    7.55E-01    8.22E-01    7.63E-01    4.33E-01
       MEDIAN      1.03E+00    8.53E-01    1.06E+00    1.02E+00    7.63E-01    1.01E+00
       NUMBER            23           6           6          26           1          62
TH-230   MEAN      1.14E+00    8.28E-01    1.09E+00    1.18E+00    7.15E-01    1.11E+00
       ST DEV      2.14E-01    1.42E-01    1.95E-01    2.35E-01    0.00E-01    2.41E-01
          MAX      1.59E+00    1.08E+00    1.37E+00    1.44E+00    7.15E-01    1.59E+00
          MIN      3.64E-01    6.02E-01    8.16E-01    7.79E-02    7.15E-01    7.79E-02
       MEDIAN      1.16E+00    8.26E-01    1.12E+00    1.21E+00    7.15E-01    1.17E+00
       NUMBER            23           6           6          26           1          62

ANALYSIS=GAMMA

TH-232   MEAN      8.42E-01    8.79E-01    8.65E-01    8.83E-01    6.79E-01    8.59E-01
       ST DEV      1.11E-01    2.10E-01    1.88E-01    6.97E-02    6.20E-03    1.43E-01
          MAX      1.13E+00    1.70E+00    1.30E+00    1.02E+00    6.85E-01    1.70E+00
          MIN      5.71E-01    6.30E-01    4.50E-01    7.30E-01    6.73E-01    4.50E-01
       MEDIAN      8.30E-01    8.08E-01    9.10E-01    8.77E-01    6.79E-01    8.50E-01
    NUMBER(1)            47          23          15          28           2         115
    NUMBER(2)            47          23          15          28           2         115

ANALYSIS=TH

TH-232   MEAN      1.18E+00    1.02E+00    1.20E+00    1.28E+00    8.95E-01
       ST DEV      2.17E-01    1.40E-01    2.01E-01    2.78E-01    0.00E-01    1.20E+00
          MAX      1.44E+00    1.23E+00    1.47E+00    1.52E+00    8.95E-01    2.52E-01
          MIN      3.75E-01    8.04E-01    9.08E-01    0.00E-01    8.95E-01    1.52E+00
       MEDIAN      1.24E+00    9.78E-01    1.24E+00    1.35E+00    8.95E-01    0.00E-01
       NUMBER                                                      8.95E-01    1.24E+00
                         23           6           6          26           1          62
U-234    MEAN      1.18E+00    7.64E-01    1.09E+00    1.01E+00    4.87E-01    1.05E+00
       ST DEV      3.92E-01    3.08E-01    2.22E-01    1.65E-01    0.00E-01    3.29E-01
          MAX      2.25E+00    1.19E+00    1.34E+00    1.24E+00    4.87E-01    2.25E+00
          MIN      3.74E-01    3.42E-01    7.42E-01    5.51E-01    4.87E-01    3.42E-01
       MEDIAN      1.12E+00    6.31E-01    1.06E+00    1.05E+00    4.87E-01    1.07E+00
       NUMBER            25           7           5          25           1          63
U-235    MEAN      5.70E-02    5.43E-02    4.97E-02    4.30E-02    2.57E-02    5.01E-02
       ST DEV      3.18E-02    3.28E-02    1.61E-02    2.13E-02    0.00E-01    2.78E-02
          MAX      1.39E-01    1.33E-01    6.98E-02    1.17E-01    2.57E-02    1.39E-01
          MIN      6.51E-03    2.99E-02    2.54E-02    1.78E-02    2.57E-02    6.51E-03
       MEDIAN      5.47E-02    4.04E-02    5.00E-02    3.68E-02    2.57E-02    4.06E-02
       NUMBER            25           7           5          25           1          63
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NUCLIDE          AREA 1     AREA 2     AREA 3     AREA 4     AREA 5      TOTAL
ANALYSIS=GAMMA

U-238    MEAN   3.57E+00   2.91E+00   3.13E+00   3.26E+00   1.94E+00   3.24E+00
      ST DEV    1.48E+00   5.14E-01   1.94E+00   1.16E+00   0.00E-01   1.37E+00
         MAX    6.21E+00   3.80E+00   5.78E+00   5.23E+00   1.94E+00   6.21E+00
         MIN    1.81E+00   2.30E+00   1.20E+00   2.20E+00   1.94E+00   1.20E+00
      MEDIAN    2.95E+00   2.77E+00   2.40E+00   2.81E+00   1.94E+00   2.77E+00
    NUMBER(1)         47         23         15         28          2        115
    NUMBER(2)         10          5          3          4          1         23
ANALYSIS=U

U-238    MEAN   1.05E+00   7.64E-01   9.15E-01   9.93E-01   7.10E-01   9.79E-01
      ST DEV    2.51E-01   2.06E-01   1.97E-01   1.17E-01   0.00E-01   2.17E-01
         MAX    1.83E+00   1.10E+00   1.22E+00   1.30E+00   7.10E-01   1.83E+00
         MIN    3.26E-01   5.33E-01   6.08E-01   7.51E-01   7.10E-01   3.26E-01
      MEDIAN    1.02E+00   7.89E-01   8.97E-01   9.77E-01   7.10E-01   9.80E-01
      NUMBER          25          7          5         25          1         63
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pCi/g dry

NUCLIDE		AREA 1	AREA 2	AREA 3	AREA 4	AREA 5	TOTAL
ALPHA	MEAN	8.37E+00	6.88E+00	5.76E+00	5.22E+00	5.95E+00	6.94E+00
	ST DEV	3.57E+00	3.31E+00	2.86E+00	3.46E+00	1.25E+00	3.63E+00
	MAX	1.62E+01	1.21E+01	9.20E+00	1.27E+01	7.20E+00	1.62E+01
	MIN	1.30E+00	1.10E+00	4.00E-01	8.00E-01	4.70E+00	4.00E-01
	MEDIAN	8.35E+00	7.60E+00	7.20E+00	4.65E+00	5.95E+00	7.20E+00
	NUMBER	48	23	15	28	2	116
BETA	MEAN	3.88E+01	3.60E+01	3.84E+01	4.03E+01	3.03E+01	3.84E+01
	ST DEV	7.58E+00	5.21E+00	6.74E+00	4.76E+00	2.75E+00	6.62E+00
	MAX	5.10E+01	4.84E+01	5.04E+01	5.43E+01	3.30E+01	5.43E+01
	MIN	1.25E+01	2.59E+01	2.53E+01	3.18E+01	2.75E+01	1.25E+01
	MEDIAN	4.01E+01	3.64E+01	3.98E+01	4.09E+01	3.03E+01	3.95E+01
	NUMBER	48	23	15	28	2	116

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